NOVEMBER 1956

World Petroleum

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TABLE OF CONTENTS PAGE 53

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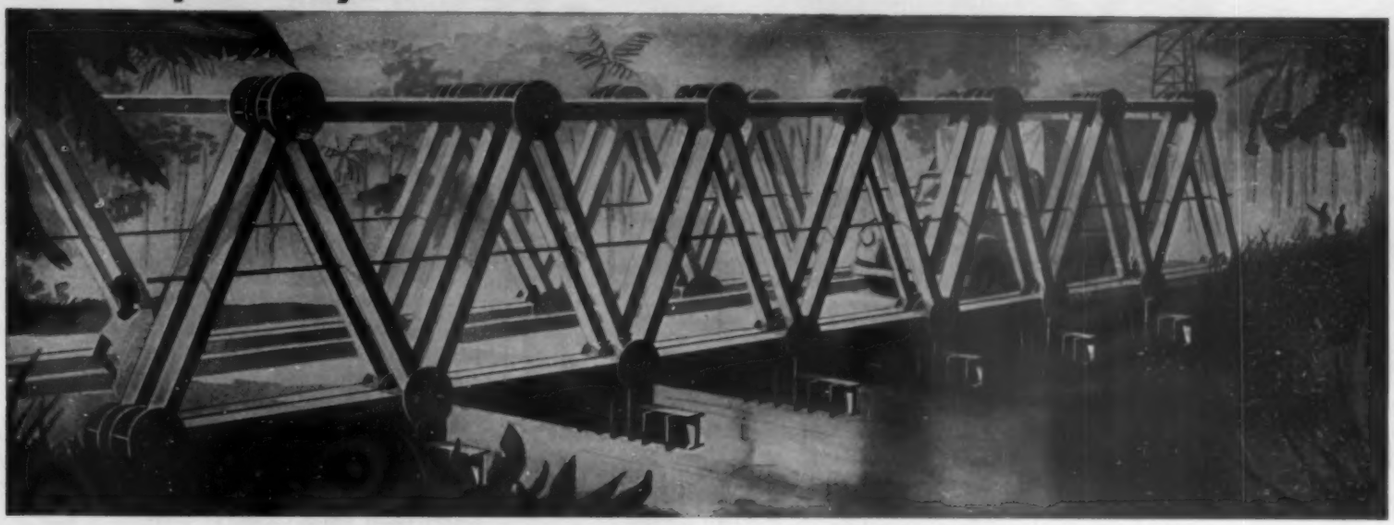

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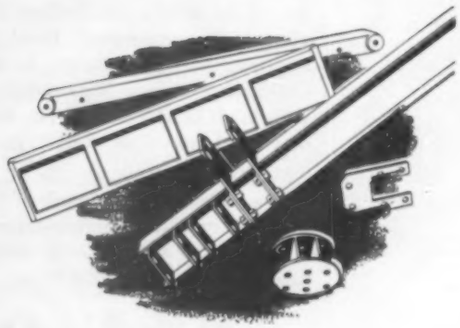

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M-3 Guns Shoot 1268 Holes in Four Hours

Firing an average of 317 bullets per hour in this shallow Oklahoma well is an outstanding record of perforating speed and efficiency.

McCullough 4¼" O.D. M-3 Bullet Guns fired 1268 improved ½" Ogival Bullets in 7" O.D. cemented casing in two intervals from 1040' to 1064' and from 2762' to 2790'. This was a salt water disposal well. Operator was well pleased.

Speed like this can only be accomplished by experienced, thoroughly trained crews and by using simultaneous firing M-3 Bullet Guns—fastest, most efficient method of bullet perforating available.

M-3's Succeed After Two Others Fail

Two other service companies attempted to perforate this Montana well without success. One was unable to accurately locate the collars and perforated the water zone. The other was unable to do the job because the shots were in dry hole and incoming pressure moved their gun up the hole.

Within 1½ hours, McCullough moved in on the job, located the zone to be perforated, fired 32 improved ½" Ogival Bullets in 5½" O.D. casing between 3955' and 3963' with 3½" O.D. M-3 Bullet Guns, tore down and moved off. Results good—operator happy.

This is just one more example of the accuracy of McCullough measurements and of the value of simultaneous firing M-3 Bullet Guns.

Superior Penetration Pays Off ...Fracturing Job Successful

Hard Shooting M-3 Bullet Gun Permits Successful Completion of Sandfrac Job...Penetrates Tough Formation After Other Bullet Gun Failed.

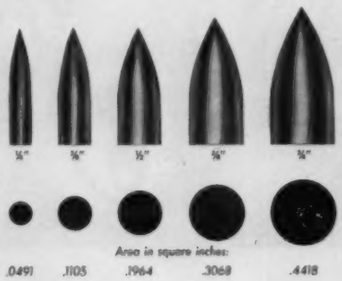
Previously perforated by another service company, the operator was unable to fracture the formation in this Illinois well; pressures up to 4000 psi were reached without results.

McCullough was called to re-perforate the well with 4¼" O.D. M-3 Bullet Guns firing improved ½" Ogival Bullets. Twenty shots were fired through 5½" 14 lb. J-55 cemented casing in a five foot interval from 2833' to 2838'.

After perforating by McCullough the well "broke down" at 1600 psi and took fracturing material at the rate of 350 gallons of oil and 700 pounds of sand per minute. This well is now flowing—one of the best in the field—and the entire perforating job, including rigging up and tearing down, required only 1½ hours rig time.

The superior firing power of M-3 Bullet Guns; the deep penetrating qualities of improved Ogival Bullets are particularly valuable where tough, tight formations must be fractured for good production.

There are many jobs like this on record, where the superior penetrating power of McCullough M-3 Bullet Guns has successfully completed the job after others failed. Next time, be sure of results—call McCullough first.



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Washington

By Joseph B. Huttlinger

The November election came after a burst of antitrust activity aimed at the American petroleum industry. The Federal Trade Commission filed price action against Sun Oil Co. and Pure Oil Co. in, respectively, Jacksonville, Fla., and Birmingham, Alabama, and disclosed it is investigating more complaints of gasoline price discrimination than in many years.

FTC has finally started its case against commissions paid major oil companies on sales of tires at gasoline stations, on grounds that the companies do not earn commissions, and they are illegal.

The Department of Justice revived the gasoline price discrimination case against Standard Oil Co. (Ind.), when many had thought the case ended with a victory for Standard, by appealing once again to the U. S. Supreme Court. The Department also resumed during October its case against Sun Oil Co., charging price fixing in gasoline. It got headlines, and put the Eisenhower administration on record in a major antitrust case, by filing an amended complaint in the case against seven oil companies on the West Coast, which is a hangover from the Truman administration.

In Texas, politicians are shooting at the price of gasoline to farmers. In New Hampshire, Gov. Lane Dwinell, up for election in November, is threatening a pre-election state grand jury investigation into gasoline prices. He threatens criminal action. A sideshow lies in the Congressional investigations into lobbying for the natural gas bill, which is producing hints that the Democratic Congressmen might like some oil contributions. A Senate Subcommittee under Senator Albert Gore, D., Tennessee, put on the stand a professor who said officers of 21 of the 22 largest petroleum companies gave to political funds during 1952. A total of $299,000 of the gifts went to the Republicans, and only $8,100 to the Democrats, he said. He listed 87 officers and directors of companies making reported gifts of $500 or more.

Only the cynical would say all this is politics. But only the naive would deny that politics is playing a huge role. One danger, both for petroleum and the nation, is that a matter once started, whether for political or other reasons, is hard to shut off.

Trade Conferences Questioned

A trade practice conference in gasoline marketing may be barred as long as there are major antitrust actions pending against petroleum companies.

PIPE LINE

That, it seems, is the attitude of the Federal Trade Commission which has rejected an appeal from gasoline dealers for a conference of dealers, major oil companies, jobbers and others, stating ". . . such proceedings should not be instituted at this time in view of the extent and nature of litigation involving members of the above-named industry which is pending in the Department of Justice and the commission."

Gasoline From Farm Products

The idea of adding alcohol made from wheat and corn to motor fuel is being talked up by the new White House Commission to find new uses for farm products. A press release from the commission says this is being studied at Peoria, Illinois, where the U.S. Department of Agriculture has a research laboratory.

Interest in the concept is intense, for this kind of use would probably wipe out the surplus of wheat and corn within a month. The "economic" problem is the stumbling block, according to Dr. G. E. Hilbert, director of utilization research of the U.S. Department of Agriculture. To make alky-gas competitive, he said, grain would have to sell for 30 to 45 cents a bushel. Actually, the price is several times higher.

The alky-gas proposal still has life, however, for government commissions have a way of doing arithmetic that is apart from strict business practice. Thus, a commission might start figuring the cost of the government price support program, of storage for wheat, of the foreign giveaways, and come to the conclusion it would be cheaper for the U.S. to turn the wheat and corn into alcohol for gasoline. Chances are, legislation would be needed.

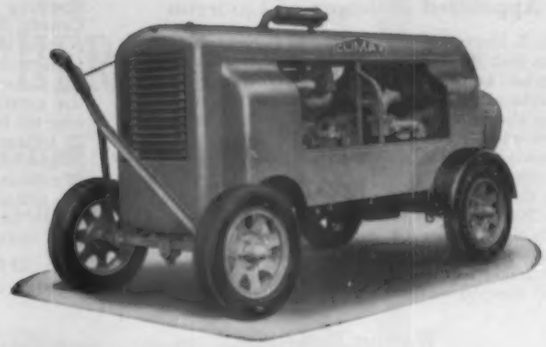
Dr. Hilbert said grain alcohol makes an "excellent motor fuel" by itself or as a blend, has definite anti-knock value, and that there are no technical problems in making grain alcohol.

Tait Named To FTC

President Eisenhower has named Edward T. Tait, a 36-year-old Pittsburgh, Pennsylvania, lawyer as a member of the Federal Trade Commission. He is to be sworn in November 2, taking the place of Lowell B. Mason, who was named by President Truman in 1945.

Mr. Tait, one of the youngest men ever on the commission, which handles antitrust and other matters, has been a special assistant to the President for two years. Before that, he was executive director of the Securities and Exchange Commission. The Senate must confirm the nomination, but Mr. Tait can serve until confirmation next year. If Adlai Stevenson is elected, presumably he would name his own man.

FOR COMPRESSORS



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Canadian Notes

Appointed Manager of Cameron

R. E. Hager has been appointed manager of Cameron Iron Works of Canada. Mr. Hager's headquarters will be in Edmonton where Cameron maintains warehousing, assembling and testing facilities. Offices also are maintained in Calgary. Mr. Hagar has been with Cameron for 13 years. He is a native of Gloversville, N. Y. and studied mechanical engineering at the University of Houston. Prior to joining Cameron, Mr. Hager was a field engineer with the National Standard Oil Co. and also associated with the McEvoy Co. as a tool engineer and with North American Aviation as chief tool engineer. Mr. Hager has had considerable field experience in well blowout work.

Watson Retires

R. T. (Russ) Watson, for 36 years a member of British American Oil's manufacturing department and most recently manager of the company's Edmonton refinery, has retired. Mr. Watson joined B-A at Toronto refinery in 1920 as a warehouseman and in subsequent years served in key capacities at Montreal, Moose Jaw, Calgary and Edmonton refineries.

New Powerformer by Imperial

Imperial Oil Ltd. has awarded a contract to Canadian Bechtel Ltd., to build a Powerformer at its Ioco refinery, near Vancouver as part of a $4 million construction program.

Parmelee Elected to Board

Maurice B. Parmelee has been elected secretary-treasurer and a member of the board of Sun Oil Co., Ltd., Sun Oil Co.'s Canadian subsidiary. John C. Agnew was elected assistant secretary-treasurer, and Frank R. Markley resigned as a member of the board but will continue as vice president.

New Canadian Alkylate Plant

A contract to engineer and construct a $3.8 million detergent alkylate plant for Imperial Oil Ltd., at Sarnia, Canada has been awarded to The Fluor Corporation of Canada, Ltd.

This plant will be the first of its kind in Canada. Its completion next summer will make Canada self-sufficient in detergent alkylate (dodecyl benzene).

Elected to Sun-Canadian Board

W. T. Askew, president of Sun Oil Co., Ltd., has been elected a member of the board of Sun-Canadian Pipe Line Co., Ltd. Two-thirds ownership of Sun-Canadian Pipe Line Co., Ltd., is held by Sun Oil Co., Ltd., Toronto, Canadian subsidiary of Sun Oil Co., Philadelphia. The election of John C. Agnew, director and treasurer, as secretary was announced and the resignation of John Blair Moffett as secretary and a director.

Westcoast Transmission Appointment

Dr. George S. Hume, formerly director general of Scientific Services, Department of Mines, Ottawa, has joined the Westcoast Transmission Co., Ltd., as vice president and chief geologist. Dr. Hume, a graduate of Yale, with the Canadian government since 1920, had been acting deputy minister of mines for the last 18 months. In his Federal Government capacity he aided in the development of the original Turner Valley oil field and in work on the Athabasca Tar Sands. He is president of the Geological Society of America and a member of: the Canadian Institute of Mining and Metallurgy, the Geological Society of Canada, Royal Society of Canada, American Association of Petroleum Geologists and the American Institute of Mining and Metallurgical Engineers.

Alberta Gas Reserves Over 25 Years Supply

A. G. Bailey of Calgary, chairman of the Gas Policy Committee of the Canadian Petroleum Assoc., has given Alberta's current gas finding rate at over 70% of Canada's total energy requirements in 1955. Speaking for the petroleum producers of western Canada, Mr. Bailey said, "According to the most reliable information available at this time, the total requirements for Alberta gas, which includes British Columbia, the Prairies, Eastern Canada, and the presently anticipated United States markets, over the next 25 years will amount to approximately 26 trillion cubic feet. It is estimated that by 1980 Albera will have remaining recoverable reserves of 62 trillion cubic feet. I wish to point out that only the period up to 1980 has been forecast, and this has by no means exhausted the gas potential of the area under discussion."

Record Deliveries by Canadian Pipe Lines

The rapid pace of pipeline construction and deliveries is continuing, with deliveries in July up to a new record for Canada of 687,871 b/d.

The page of deliveries will be quickened when new pumping stations and additions to the present system are complete. The Westspur pipe line in southeastern Saskatchewan will be looped next year, due to rapid growth of markets in eastern Canada, formerly supplied by Alberta crude, and in the northern states which are deficient in medium gravity crude supply. This will also increase throughput for Interprovincial Pipe Line Co., as Westspur feeds into its line at Cromer, Manitoba.

The fast-growing oil pipe line network in Canada added up to 5,069 miles of line at the start of this year. This is up from 4,656 miles a year earlier. Another 1,514 miles of oil pipe line in the U.S. are devoted to carrying of Canadian crude oil. More lines are being built.

The total of oil delivered, mostly crude oil, came to 224,274,768 barrels during 1955, up 30% from the 172,495,935 barrels the year before. This represents deliveries through oil lines in Canada.

The Canadian natural gas network came to 4,143 miles at the start of this year, and there were 5,538 miles more of distribution lines. As in the past, greatest mileage was in Ontario, followed by Alberta and Saskatchewan. New Brunswick was unchanged. British Columbia has a modest mileage. Natural gas pipe line expenditures during 1955 consisted of $22 million for gathering and transmission lines and $20 million for distribution lines during 1955. This represented an increase of 50% over the total of $28 million spent the year before for both types of lines.

Trans Canada Case Strengthened

The United States may change its policy and start to rely on Canadian natural gas as a primary source of supply for some communities. A broad hint of this came in a tentative decision by an examiner for the Federal Power Commission in a case involving Tennessee Gas Transmission Co. and others.

The examiner, Francis L. Hall, foresaw a shift in policy if Alberta gas reserves prove to be in excess of Canadian needs and able to take care of substantial U.S. demands. If this comes, he said, "the commission may well want to reconsider the question of whether communities within the United States will now be permitted to rely solely upon a Canadian source of gas in the event they have no peak-shaving or other gas producing facilities of their own."

The FPC set down a policy some years ago in the case of the Westcoast Transmission Co., of Calgary, that it preferred U.S. communities to have U.S. gas as their main reliance. The FPC said it had no objections to Canadian gas as a secondary source.

Upon this, the FPC gave a certificate to the Pacific Northwest Pipeline Corp., Houston, Texas, to serve the U.S. Pacific Northwest. Westcoast, supplied with Canadian gas, later was permitted to dome in and supplement the market.

Examiner Hall also revived the idea of a natural gas treaty between the United States and Canada to pave the way to international exchange of gas.

"It may be," he said, "that approval of such a treaty could be obtained, for both countries would stand to benefit and the stability of the whole situation would be sustained."

A treaty, he explained, could help assure a definite supply of gas, over an appropriate period of time, and at a reasonable and stable price. "Canada would not only be able to meet the requirements of its growing economy on the best terms that could be provided," he said, "but would also be able to dispose of gas it does not need. The United States will have an additional dependable source of supply, reasonably close to available markets."

A checkup with natura gas company officials, and officers of U.S. and Canadian governments indicates that a natural gas treaty is something for the dim future, if ever. Few persons could be found heartily in favor of a treaty of his sort. The State Department in the U.S., an official said, completed a study of the economic and political factors involved more than 18 months ago, and came to the conclusion that a treaty is fraught with problems in the preparation, and in its operation.

Officials handling natural gas matters in both governments, presumably, would have to give up some rights under a treaty that would have any force, it was pointed out. Thus, there was some surprise an FPC official revived the idea.

The appeal in the treaty idea is that it might solve problems in plans to carry gas across the border. A chief one lies in the fact that the U.S. must have proof of dedicated gas reserves for 20 years before it will give a certificate to a natural gas pipe line firm. And if the gas is in Canada, this proof is hard to present to the FPC, since the gas is under control of a foreign government. The reverse is true in other cases as where Tennessee Gas Transmission Co., exports to Canada at Niagara Falls, and Panhandle Eastern Gas Co. in the Midwest.

Construction on the Alberta-Winnipeg section of Trans-Canada's 2,250-mile natural gas line. In order to achieve required flexibility for lowering the heavy pipe, a long section is handled at a time.

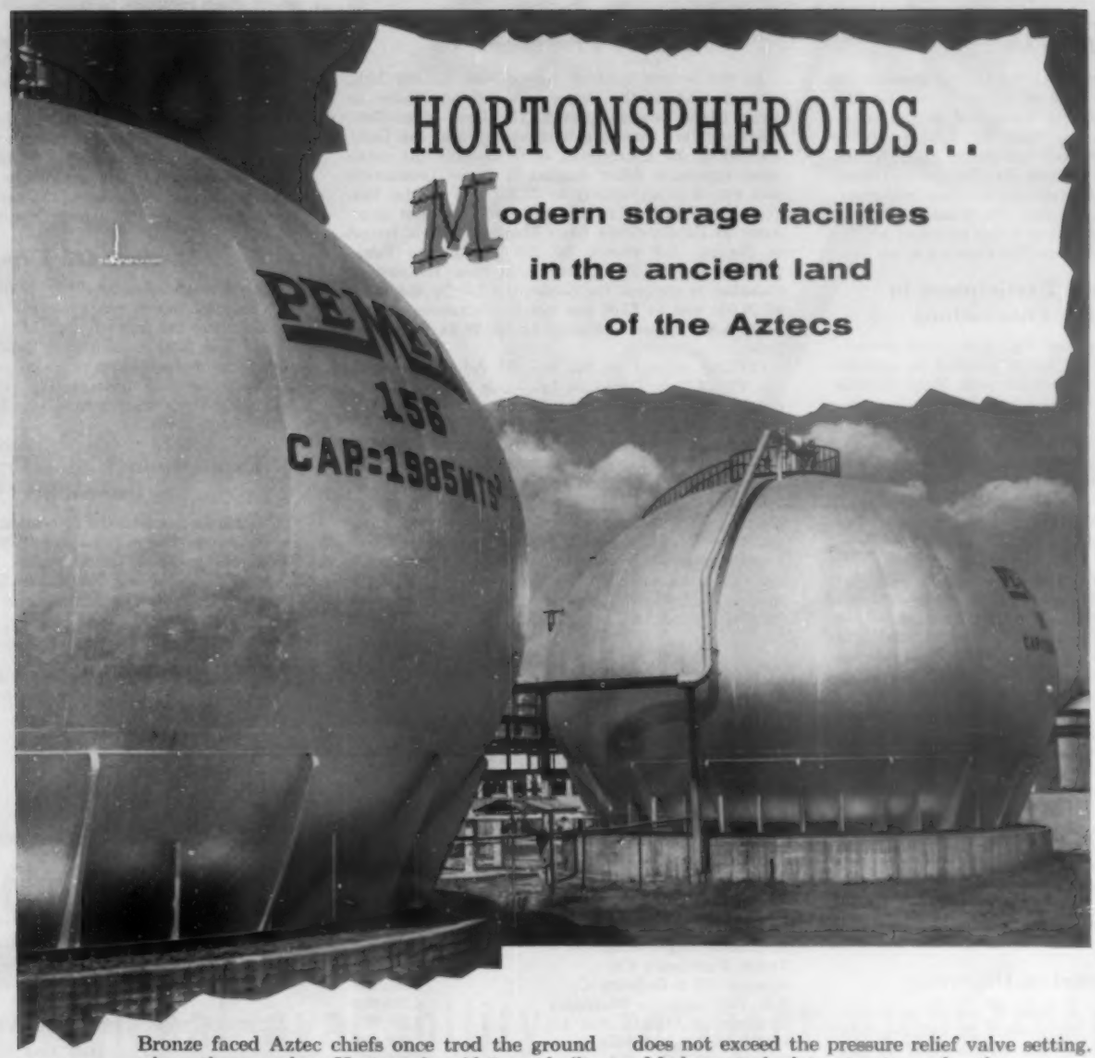
New Pipe Lines Manager

M. L. Bright has been appointed as pipe lines manager for British American Oil Co., Ltd., production department, Calgary. Mr. Bright will be responsible for the company's pipe line operations in western Canada.

Canadian Oil Companies Appointments

Several changes have been made in the refinery organization of Canadian Oil Companies, Ltd. The changes were made necessary by the rapid growth of the company's manufacturing operations and by a move to consolidate all manufacturing operations at Sarnia. J. M. Allan, formerly chief chemist at Sarnia, has been appointed chief lubricating research chemist and is transferring from Montreal to Sarnia. He is succeeded by E. A. Work, formerly senior refinery chemist.

D. F. Rhodes who has headed up lubricating research work at Montreal has been appointed assistant to the manager of manufacturing. Mr. Rhodes joined the company in 1936 at the Petrolia refinery as a chemist.



Bronze faced Aztec chiefs once trod the ground where these modern Hortonspheroids® are built. Located at Petroleos Mexicanos Atzcapotzalco Refinery on the outskirts of Mexico City, a city whose foundations were laid on the ruins of an old Aztec temple, these Hortonspheroids provide dependable pressure storage for the refinery's volatile hydrocarbons. No vapor can escape from a Hortonspheroid as long as the internal pressure does not exceed the pressure relief valve setting.

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Latin American Oil News

Brazil Refines 65% Needs

Colonel Nunes, Petrobras head, says Brazil's refineries now produce 83% of the gasoline, and 65% of all petroleum products, consumed in the country. Plans for building a 90,000 b/d refinery in the Federal District are well advanced. Mr. Nunes, referring to a bill to include distribution and commerce of petroleum products in the state monopoly, told Congress in August that Petrobras is in favor of monopolizing imports, but is not prepared to distribute petroleum products. The country is too vast.

International Participates in Venezuelan Concessions

International Petroleum Co., Ltd., will participate in new concessions being granted in western Venezuela under an agreement with Mene Grande Oil Co. that permits International Petroleum to secure a 25% interest in concessions that Mene Grande acquires in Venezuela.

International Petroleum, an affiliate of Standard Oil Co. (N.J.), announced recently that for $7.25 million it had accepted a 25% interest in two Lake Maracaibo exploration concessions acquired by Mene Grande during late August covering 21,262 acres.

The Venezuelan government recently accepted Mene Grande's application for four other exploration concessions in Lake Maracaibo totaling 108,600 acres. When titles are granted, International will have the opportunity of acquiring a 25% interest at a cost of about 26.4 million. In addition, Mene Grande has pending four applications for exploration concessions covering about 101,000 acres in southwestern Venezuela.

In 1955, International's gross crude oil production was 109,581 b/d of which 72% came from Venezuela. The company's Venezuelan crude production for the first seven months of this year is up 12.6% over the same period last year. International Petroleum produces, refines and markets oil in Peru and Colombia and has a limited marketing operation in Ecuador. Other than Venezuela, International's principal crude production comes from the area around Talara, along the northwestern coast of Peru.

New Venezuelan Discovery

Discovery of a new oil field in the Greater Oficina producing area in the western part of the State of Monagas which could add substantially to future production and reserves has been announced by Sinclair Oil Corp.'s subsidiary, Venezuelan Petroleum Co. The discovery well, Aguasay No. 3, was drilled to a total depth of 14,221 feet, and encountered a number of potential producing sands totaling over 200 feet of thickness. Tests on one of the lower sands produced 35.10 API gravity oil at the rate of 689 b/d, with thicker and more promising sands yet to be tested. The well is on a block of 92,600 acres. A second location has been made to drill immediately.

Temporarily, the company plans to use nearby transportation facilities of other companies for production from the new field, but studies are being conducted toward a connection with a sixteen-inch pipe line about thirty miles to the north, in which Venezuelan Petroleum owns a one-third interest.

The company recently completed its 15th producing well in the Barinas field of western Venezuela. On initial tests, the fifteen wells totalled about 17,000 barrels of oil daily. This production, however, is currently shut-in, awaiting completion of the pipe line from the Barinas area to Puerto Cabello on the Coast. The line is expected to start delivering oil after mid-1957. Four drilling rigs are currently developing the Barinas field. The company hopes to be able to add at least 25,000 b/d from Barinas when the pipe line begins operation. Daily net production of Venezuelan Petroleum is now at the rate of 25,700 barrels, against 20,300 b/d at this time last year.

Brazil's Production Up

In the second half of August the 125,000 bbls. storage tank at the ocean terminal on Madre de Deus Island was completed. The Catu-Mata-Candeias pipeline then began operating and the Catu, instead of the Candeleias, wells became the principal suppliers. After August 22 crude production was raised progressively to 21,032 b/d on the 28th (compared with 7,734 b/d in July). The first shipment of Bahlia crude from Madre de Deus Island to Santos, and thence by the Santos-Sao Paulo pipeline to the Presidente Bernardes refinery at Cubatao, is planned for September 10. On the basis of 20,000 b/d at $3.00 per barrel, Petrobras anticipates a saving on exchange of $60.00 as from that date.

Drilling started at the end of August on well No. TRI-AZ on Trinidade Island, at the confluence of the Madeira and Amazon Rivers. At least 6 other wells, 3 stratigraphic and 3 wildcats, will be started in the Amazon region this year. Maranham the Testa Branca wildcat showed signs of gas and oil at 5,408 feet; Mocambo, gas only at 9,301.

During the first half of 1956 23 wells were completed in the Bahia Reconcavo, 19 are producing oil, 4 are dry; 8 others are now being drilled and 8 are being prepared for drilling. Total footage drilled in Bahia Jan-June 119,350 ft. In August 9 seismic, 6 gravimetric and 17 geological teams were operating in Brazil.

Signal to Operate in Venezuela

Notice has been received by the foreign exploration subsidiaries of The Hancock Oil Co., The Pure Oil Co., and The Standard Oil Co. (Ohio), and Signal Oil & Gas Co., that their bid for Venezuelan oil concessions has been accepted by the government. Each company holds 25% interest with Signal acting as operator for the group.

The parcel to be granted the joint group contains over 27,000 acres located in Lake Maracaibo, and is immediately adjacent to producing properties of other operating companies.

Development work leading to drilling operations is expected to commence later this year. The recent completion of a $50 million dredging project makes Lake Maracaibo itself accessible to ocean-going tankers, thereby eliminating the necessity for transporting oil by pipe line over long distances.

Mexican Oil Exports

With foreign sales totaling 139,000,000 pesos, fuel oil occupied fourth place among all Mexican exports during the first quarter of this year, according to the National Foreign Trade Bank. Crude petroleum was eleventh, with shipments valued at 22,600,000 pesos. Petroleum and derivatives worth 171,800,000 pesos were purchased abroad by Mexico in the same period.

Exploration Rights Granted in Guatemala

Guatemala has issued exploration rights to Story Jones Sloane. The rights cover 19,000 hectares (46,930 acres) in Lake Izabal region. Duration is six years. Sloane applied November 23, 1955. This is the second grant. The first was to Signal Oil and Gas Co., on May 29, 1956.

Venezuelan Crude & Refinery Production

Crude oil production in Venezuela in the first half of this year came to 430,055,439 barrels, according to Venezuelan government sources.

The production by companies:

CRUDE PRODUCTION IN VENEZUELA

1st Half 1956

Cia Shell de Venezuela, Ltd.	121,837,250
Colon Development Co., Ltd.	3,561,675
Creole Petroleum Corp.	190,056,621
Mene Grande Oil Co.	63,475,938
Socony Mobil Oil Co. de Venezuela	16,491,914
Richmond Exploration Co.	9,218,221
Texan Petroleum Co.	8,686,471
Sinclair Oil & Refinery Co.	5,360,495
S.A. Petrolera Las Mercedes	4,383,174
Venezuelan Atlantic Ref. Co.	3,596,163
Phillips Petroleum Co.	1,928,483
Pantepec Oil Co., C.A.	1,015,212
Talon Petroleum C.A.	422,059
Caracas Petroleum, S.A.	19,763
Total	430,055,439

Natural gasoline production in the first half of 1956 came to 550,337 barrels, and butane production to 362,097 barrels, all by Compania Shell de Venezuela, Ltd.

Production of refined products came to 106,122,031 barrels. Crude oil throughout was 103,619,007; crude transferred to fuel oil was 2,096,815; and distillates and blending stocks came to 406,209.

Refined products obtained, by product, amounted to 106,105,000 barrels during the first half of the year.

REFINERY PRODUCTION—1st Half 1956

(Barrels)

Fuel oil	59,349,320	Jet fuel	955,281
Gasoline & naphtha	13,309,351	Stripped crude	2,458,730
Diesel oil	13,149,924	Asphalt	627,472
Gasoil	6,866,611	Aviation lubes	616,835
Kerosine	3,246,149	Miscellaneous	4,299,454
Still gas	991,795	Losses	251,109
		Total	106,122,031

By companies, the leader was Creole Petroleum Co., with 44,885,283 barrels.

VENEZUELAN REFINERY PRODUCTION

1st Half 1956

Creole	44,885,283
Shell Group	41,771,930
Sinclair	4,972,797
Texas	1,163,877
Venezuela Gulf Ref. Co.	10,232,795
Phillips	408,827
Richmond	2,579,605
Total	106,015,114

Crude oil exports during the first half came to 324,354,241 barrels. Principal destination was Aruba, followed by the United States.

CRUDE EXPORTS FROM VENEZUELA

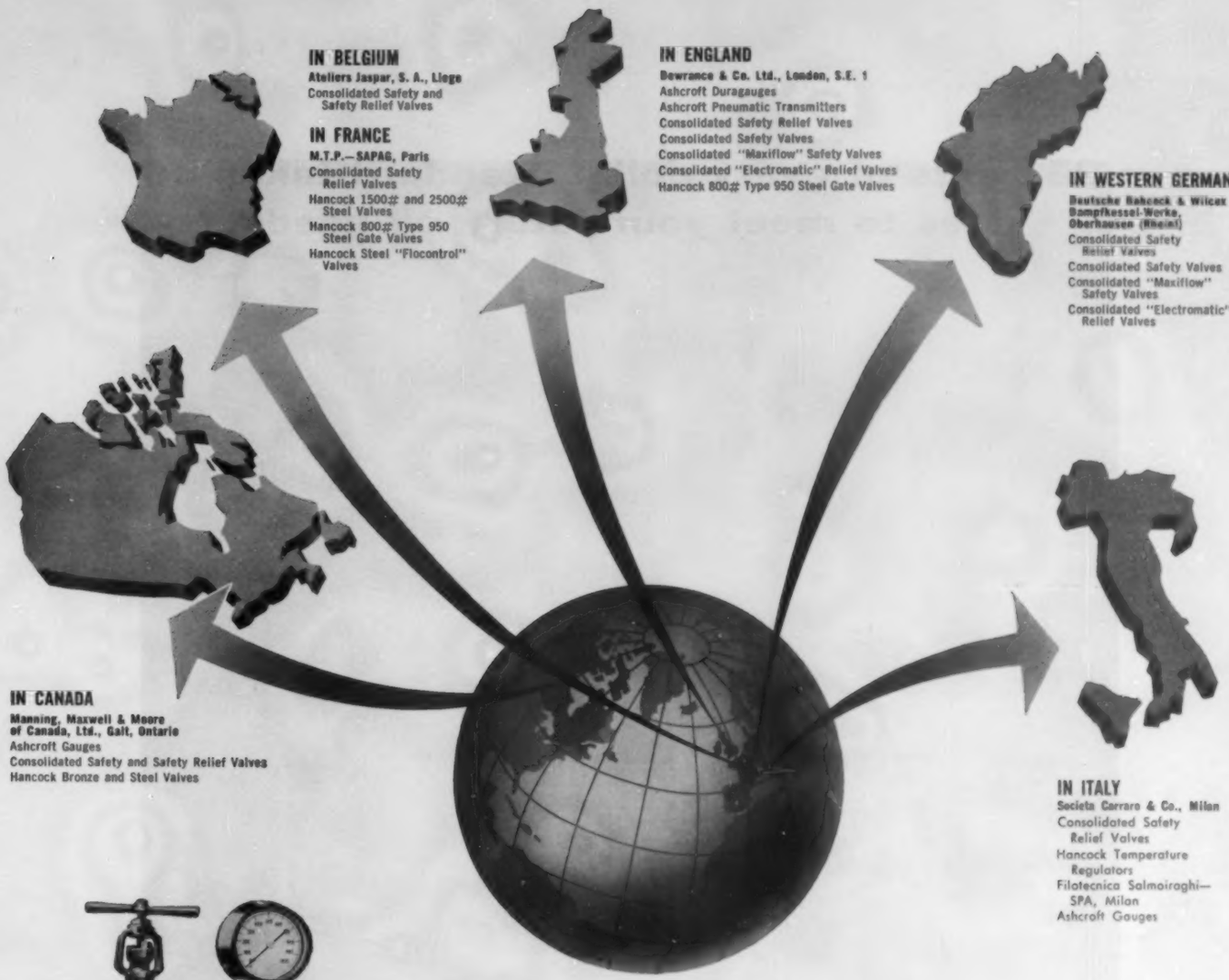
Last Half 1956

(Barrels)

Destination	
Aruba	88,157,835
U.S.A.	76,630,403
Curacao	59,689,282
Canada	34,291,778
Netherlands	12,963,948
United Kingdom	10,072,171
Brazil	10,027,260
British West Indies	7,716,245
Argentina	7,140,584
Puerto Rico	3,800,217
Uruguay	3,049,065
Italy	2,218,420
France	1,809,49[illegible]
Canary Islands	1,712,77[illegible]
Germany	1,381,765
Chile	1,853,481
Belgium	805,868
Sweden	429,066
Norway	315,154
Australia	188,826
Cuba	100,602
Total	324,354,241

Refined product exports came to 78,124,215 barrels, of which 52,910,719 was fuel oil and 10,448,841 diesel oil. The U.S. received 29,325,949 barrels of the fuel oil.

(*Continued on page* 140)



IN BELGIUM
Ateliers Jaspar, S. A., Liege
Consolidated Safety and Safety Relief Valves

IN FRANCE
M.T.P.—SAPAG, Paris
Consolidated Safety Relief Valves
Hancock 1500# and 2500# Steel Valves
Hancock 800# Type 950 Steel Gate Valves
Hancock Steel "Flocontrol" Valves

IN ENGLAND
Bewrance & Co. Ltd., London, S.E. 1
Ashcroft Duragauges
Ashcroft Pneumatic Transmitters
Consolidated Safety Relief Valves
Consolidated Safety Valves
Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves
Hancock 800# Type 950 Steel Gate Valves

IN WESTERN GERMANY
Deutsche Babcock & Wilcox Dampfkessel-Werke, Oberhausen (Rhein)
Consolidated Safety Relief Valves
Consolidated Safety Valves
Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves

IN CANADA
Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario
Ashcroft Gauges
Consolidated Safety and Safety Relief Valves
Hancock Bronze and Steel Valves

IN ITALY
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Consolidated Safety Relief Valves
Hancock Temperature Regulators
Filotecnica Salmoiraghi—SPA, Milan
Ashcroft Gauges

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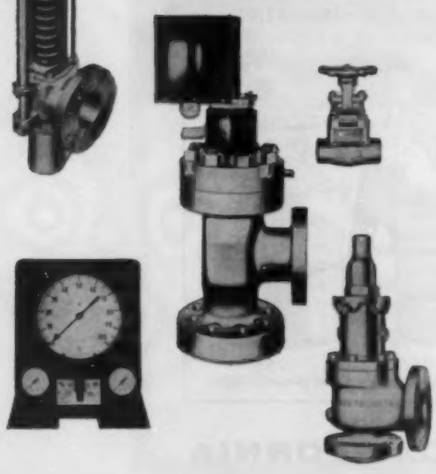

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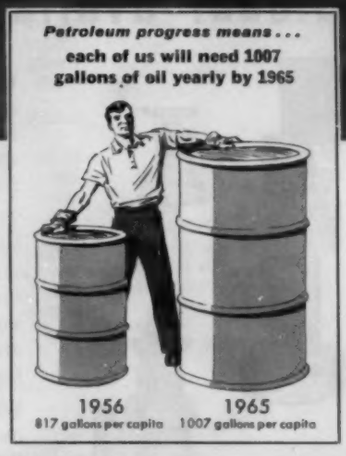
Petroleum progress means . . .
each of us will need 1007 gallons of oil yearly by 1965
1956
817 gallons per capita
1965
1007 gallons per capita

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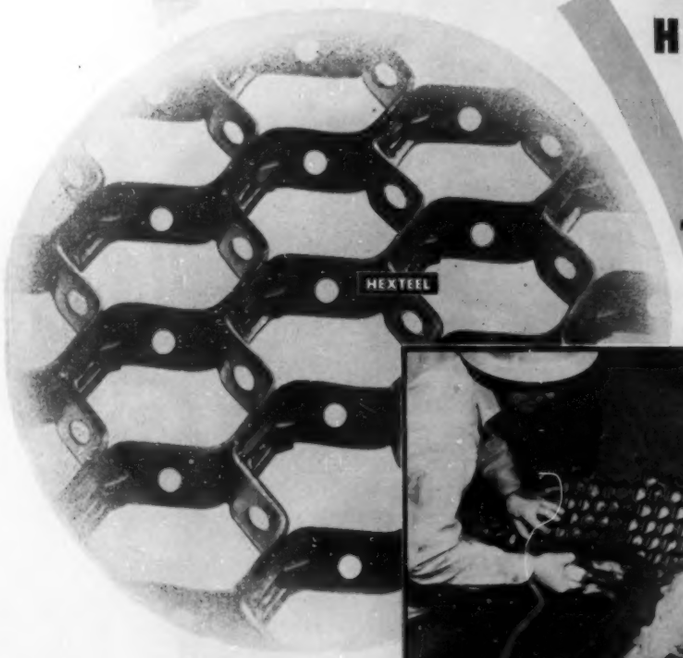
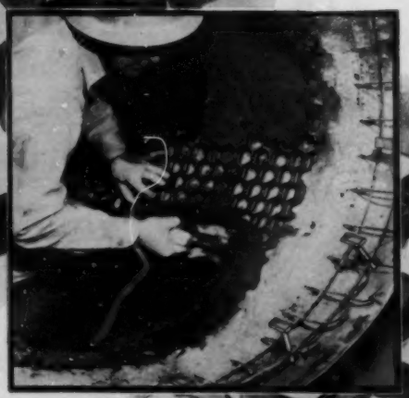
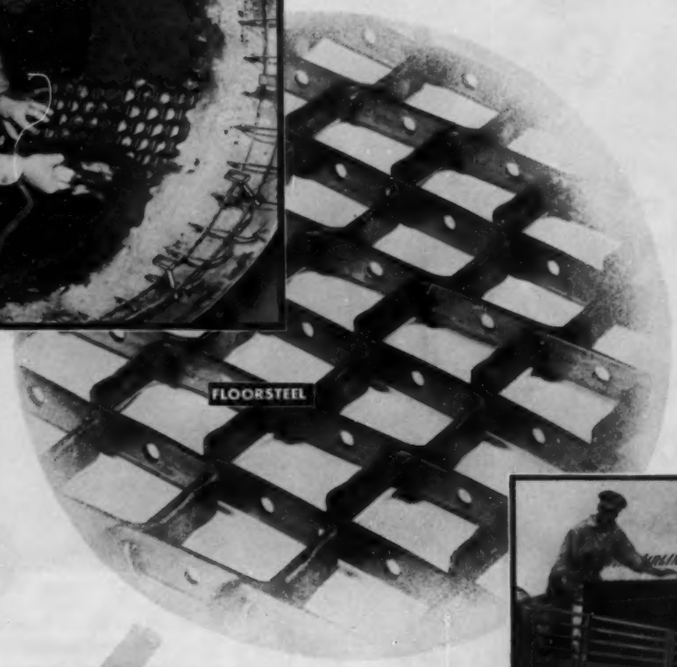


HEXTEEL is a steel armor and retainer for castable refractory monolithic linings used for cat crackers, reactors, regenerators, fractionators, heaters, strippers, risers, stacks, cyclones, ducts, breeching, furnaces and tanks.





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New Research on Antiknock Action

by **ELLIS B. RIFKIN**, *Ethyl Corporation, Detroit, Mich.*

Although tetraethyllead is widely used as an antiknock agent, some fundamentals of its action are still not completely understood. Since a full understanding of the mechanism of its action could presumably lead to increased effectiveness of utilization—the Ethyl Corporation conducts a continuing basic research program on antiknock compounds.

Many theories concerning the mechanism by which tetraethyllead acts as an antiknock agent in the internal-combustion engine involve either the process by which tetraethyllead decomposes in combustion or the products resulting from such decomposition.

This report describes the studies of variables affecting the decomposition of tetraethyllead both in fired engines and in motored engines in the laboratory.

In a first series of experiments, a spark-ignited, fixed-compression ratio, L-head engine was employed. This engine was equipped with a sampling valve of special design, which permits repetitive extraction of small samples for analysis from the end-gas region of the combustion chamber.

Mixtures of iso-octane and normal heptane were used as fuels, and end-gas samples were taken at 5° intervals from 25° before top center to 20° after top center. The results of these studies show:

1. That essentially all the tetraethyllead is decomposed before the mixture is consumed by the flame front in the cylinder.

2. That the rate of tetraethyllead decomposition is very markedly affected by the fuel composition.

In order to resolve this effect of fuel composition more completely, it was decided to conduct a second series of experiments—this time in a motored engine—to permit measurement of temperatures. A single-cylinder engine was again used, but in this series of experiments, the engine was of the variable-compression ratio type to permit variation of temperature and pressure of the fuel-air mixture over as wide a range as possible.

Mixtures of iso-octane and normal heptane as well as di-isobutylene were the fuels tested. Again, an apparent correlation was obtained between fuel composition and rate of tetraethyllead decomposition—with the more rapid rates being associated with fuels of higher octane number.

To gain still greater insight into this relationship, technicians calculated peak cycle temperatures, and the tetraethyllead decomposition data were examined against this variable. It was seen immediately that most of the variation due to fuel composition was eliminated. This leads to the conclusion that temperature may be the one basic variable governing the decomposition of tetraethyllead—and that fuel composition has only an indirect influence so far as it affects the peak temperature of the charge in the cylinder. A mathematical analysis taking into account the variation in temperature of the charge throughout the cycle and comparison of those data with tetraethyllead decomposition data confirm this conclusion.

What Ethyl Research offers you

Ethyl Research is in the unusual position of being able to serve both the petroleum and automotive industries.

In that capacity, we have contributed much in the field of fundamental as well as applied research. Today at our laboratories in Detroit we are conducting studies on the nature of combustion . . . the cause of preignition . . . and the mechanism of engine deposit accumulation.

Searching for answers to these "basic" problems has led us to develop many new instruments and new techniques. The information which we have developed from our research efforts is being constantly circulated throughout both the automotive and petroleum industries to help companies in their research.

If you desire any information concerning fuel-engine problems, just contact your Ethyl representative.

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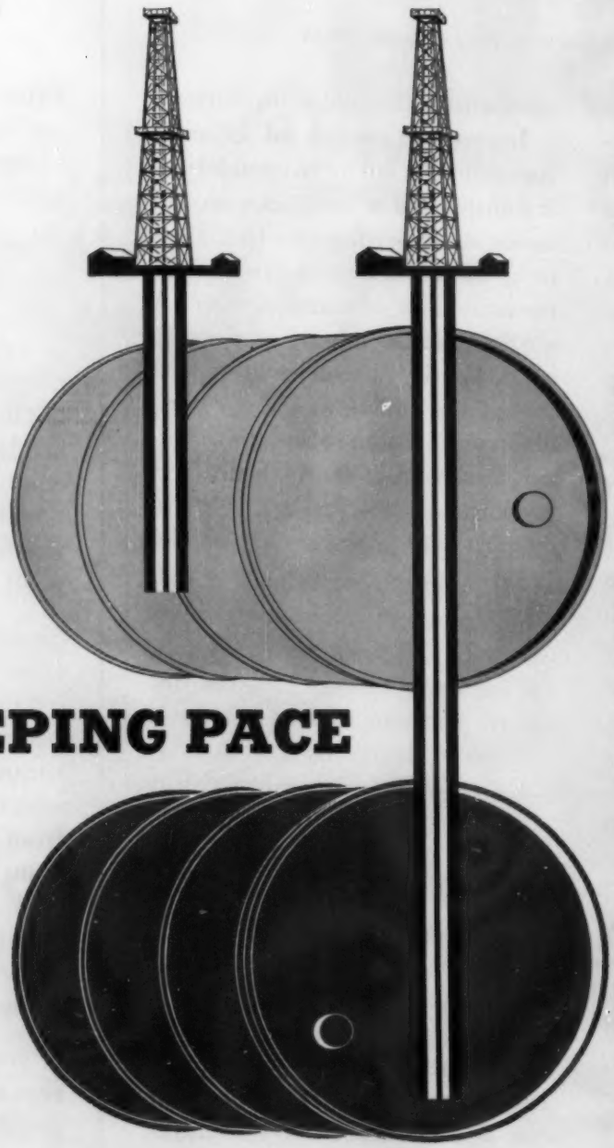

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The change in drilling that forty years has brought well symbolizes many advances in the petroleum and chemical industries. Engineers have dug more deeply into the secrets of nature, too . . . have designed plants and processes to wrest new products and services from petroleum, ores and elements.

We mentioned 1916 because that is the year Sun Ship was founded. It has long served the swift-growing needs of petroleum and chemical industries. Year by year, the engineering skill and facilities of the great Sun Ship plant have proven their ability to meet the demands for plant and equipment keyed to the swift pace of progress in these and other important fields. Sun Ship keeps pace with progress.

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8—Design to provide: structural column supports—Ladders—Platforms—Tube Removal facilities, etc.
9—Degree of assembly; of the furnace structure and of the heating surface.

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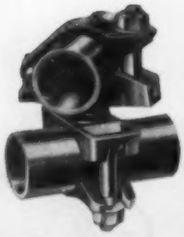

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DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

November ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

Du Pont uses sports car to study fuel-injection related to product development

Although sports cars are designed for road racing or as a highway hobby, the Du Pont Petroleum Laboratory is now using one for an entirely different purpose.

With an eye to future automotive fuel requirements, the laboratory is now fitting out a new Mercedes-Benz, 300 SL, with special instrumentation. The objective is to investigate the additive needs of fuels for fuel-injection engines and to test promising candidates under actual road conditions. The Mercedes-Benz was picked for this work because it is the only car with a fuel-injection engine that is commercially available in this country.

Mercaptide problems solved with DMD

If you are not now using Du Pont Metal Deactivator in your heating and diesel fuels, we believe you will be interested in the success of other refiners who have used it.

Several years ago, for example, a major oil company was having copper mercaptide problems. They encountered the trouble in both straight-run diesel fuel and No. 2 fuel oil composed of 95% straight-run and 5% Houdry cat-cracked.

To solve the problem, 2 pounds of DMD per 1,000 barrels were added to both fuels. This proved highly successful for several seasons. Then the use of DMD was discontinued. The trouble recurred. So DMD was again added, and this company's mercaptide problem was again under control.

Another major company encountered gel-clogging complaints in the Spring of 1955. The trouble involved a No. 2 fuel oil composed of fluid cat-cracked and straight-run. The cracked component varied in composition from 75% to 90%.

During the next heating season, the company added 2 pounds of DMD (in combination with Du Pont Fuel Oil Additive No. 2) per 1,000 barrels. There were no complaints of mercaptide formation reported the following season.

These are only two of the many success stories reported by refiners using DMD to combat mercaptide problems and complaints. And many refiners have found that since the cost of adding effective amounts of DMD is so low, it pays to use it as an "insurance" against copper contamination in a wide variety of products.

Greases containing Du Pont Estersil GT prove highly successful in many types of service

It was about two years ago that Du Pont estersil grease thickener was first introduced.

Since then, millions of pounds of grease made with this unique thickening agent have been used in a wide variety of industrial and automotive applications. And the success obtained with these greases has been truly outstanding.

Photo courtesy Joy Mfg. Co.

CONTINUOUS MINER—completely lubricated with estersil grease

One coal mining company, for example, reports that they eliminated the need for using three different mining equipment lubricants by standardizing on semi-fluid estersil-based grease in their continuous miners, loading machines and shuttle cars.

In the gear cases of the continuous miners, this company, before using an estersil grease, had a lubricant consumption of two to three *gallons* per shift. When they changed to an estersil grease, they found that the average consumption immediately dropped 75% to two to three *quarts* per shift. On loaders they actually stopped keeping records because the consumption was so small.

Longer gear life

When rebuilding machines, this same company had almost always replaced bearings and gears. But since switching to the estersil grease, they found that the gears could be used over and over again without significant wear. This was probably due – at least partially–to the fact that the estersil grease effectively sealed out moisture, dirt, coal dust and other abrasive foreign matter.

Maintenance costs down

Another user in the coal industry re-

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

CONTINUED *Estersil GT*

ports that the use of an estersil-based grease has caused his maintenance costs on a group of cutting machines to drop from .185 cents per ton to less than .09 cents per ton—a 50% saving.

Many users report that equipment runs much cooler and quieter with estersil-based greases.

In addition to heavy-duty industrial applications, estersil greases have been used in several automotive applications. In passenger cars, test engineers

THIS DEMONSTRATION dramatizes the unusual water resistance of estersil greases. They can be immersed in boiling water for long periods without breakdown.

report, these greases greatly prolong the smoother, easy-riding effect of a fresh lube job.

In heavy-duty earth-moving equipment, estersil greases often provide significant savings in downtime and maintenance costs. In some instances, crane and shovel operators reported an almost immediate cessation of leakage from hoist drum bearings on to the brake bands after switching to estersil grease.

Exceptional water resistance

Du Pont Estersil GT is an entirely *new type* of grease thickener. It is a pelletized form of finely divided amorphous silica. One of its unique features is that each minute particle is enveloped in a chemical "raincoat" which gives estersil-based greases positive, built-in water resistance and eliminates the danger of washout.

Continued middle next column

ASSISTANT TO THE SALES MANAGER—ADDITIVES

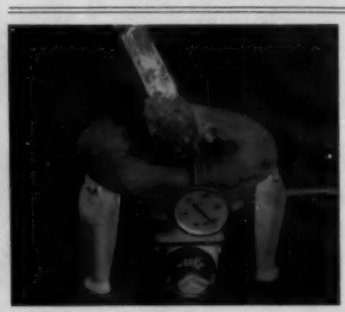
RICHARD O. BRAENDLE joined the Du Pont Company in 1944 after receiving his B.S. degree in Chemical Engineering at Massachusetts Institute of Technology.

He was first assigned to the Grasselli Chemicals Department's Experimental Laboratory in Cleveland. There he did development research on inorganic chemicals, mainly estersils. In 1950, he was transferred to the Du Pont Experimental Station in Wilmington where he worked on the application of estersils as grease thickeners.

He joined the Technical Section of the Petroleum Chemicals Division in 1952, continuing his product development work on estersil GT. During 1955 he did market research analysis for a number of petroleum additives which led to his current assignment as assistant to the sales manager for additives.

During World War II, Mr. Braendle served in the U. S. Army as a researcher and supervisor of a manufacturing operation on the Manhattan Project. He is a member of the American Chemical Society and the American Society of Lubrication Engineers.

RICHARD O. BRAENDLE



ESTERSIL GT greases stand up unusually well even under the combined action of intense heat and vigorous mechanical working.

Excellent heat and shear stability

Estersil greases are non-melting, and extremely wide temperature ranges produce little change in their consistency.

Even under prolonged high-shear, high-temperature operating conditions, greases made with Du Pont Estersil GT show outstanding resistance to mechanical breakdown.

Handling qualities

Greases thickened with estersil can be easily handled in any application—because their unusually high thermal and mechanical stability permits use of a much softer grease.

Estersil greases can be easily made, too. A milling operation is all that is required because of the completely synthetic, preformed thickening structure of estersil GT.

A Du Pont Petroleum Chemicals Division representative will be glad to give you more detailed information on estersil GT. Contact any of our sales offices listed below.

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Our line of FORGED CARBON STEEL BACK-UP FLANGES have found wide acceptance in stainless and other alloy piping installations of lightwall pipe. (Schedules 5 & 10.) We believe the economy effected by their use warrants your consideration.

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THE WELL HASN'T YET BEEN DRILLED that can apply the pressure Timken® oil and gas well steel tubing can take. To meet the trend to deeper wells and higher pressures, here's tubing that can take internal pressures up to 15,000 psi.

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Timken seamless steel tubing is available in a variety of sizes and analyses. Some are specially selected for corrosion resistance. All provide high ductility.

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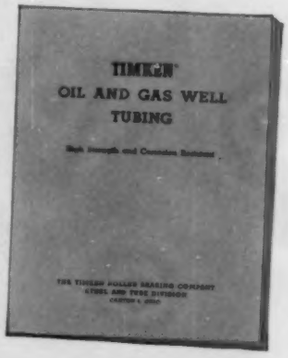

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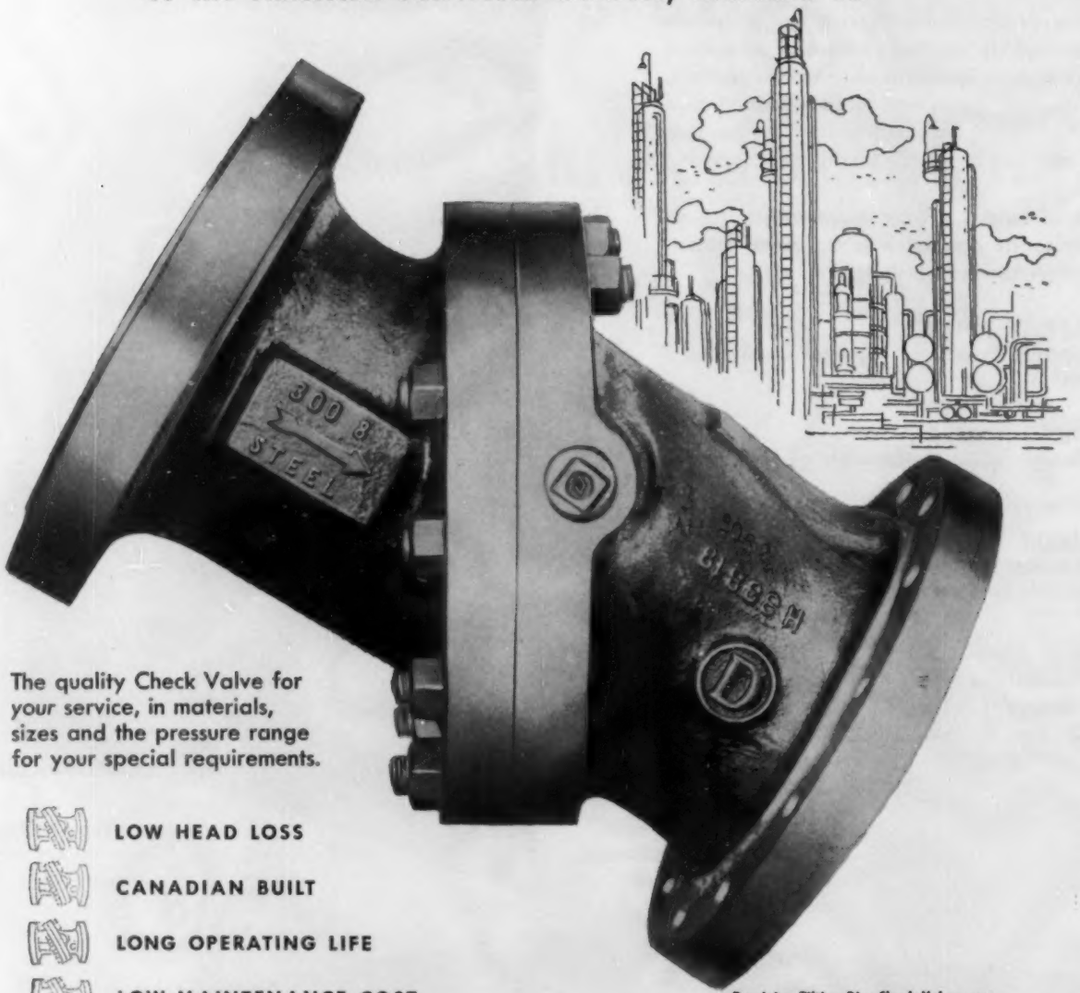

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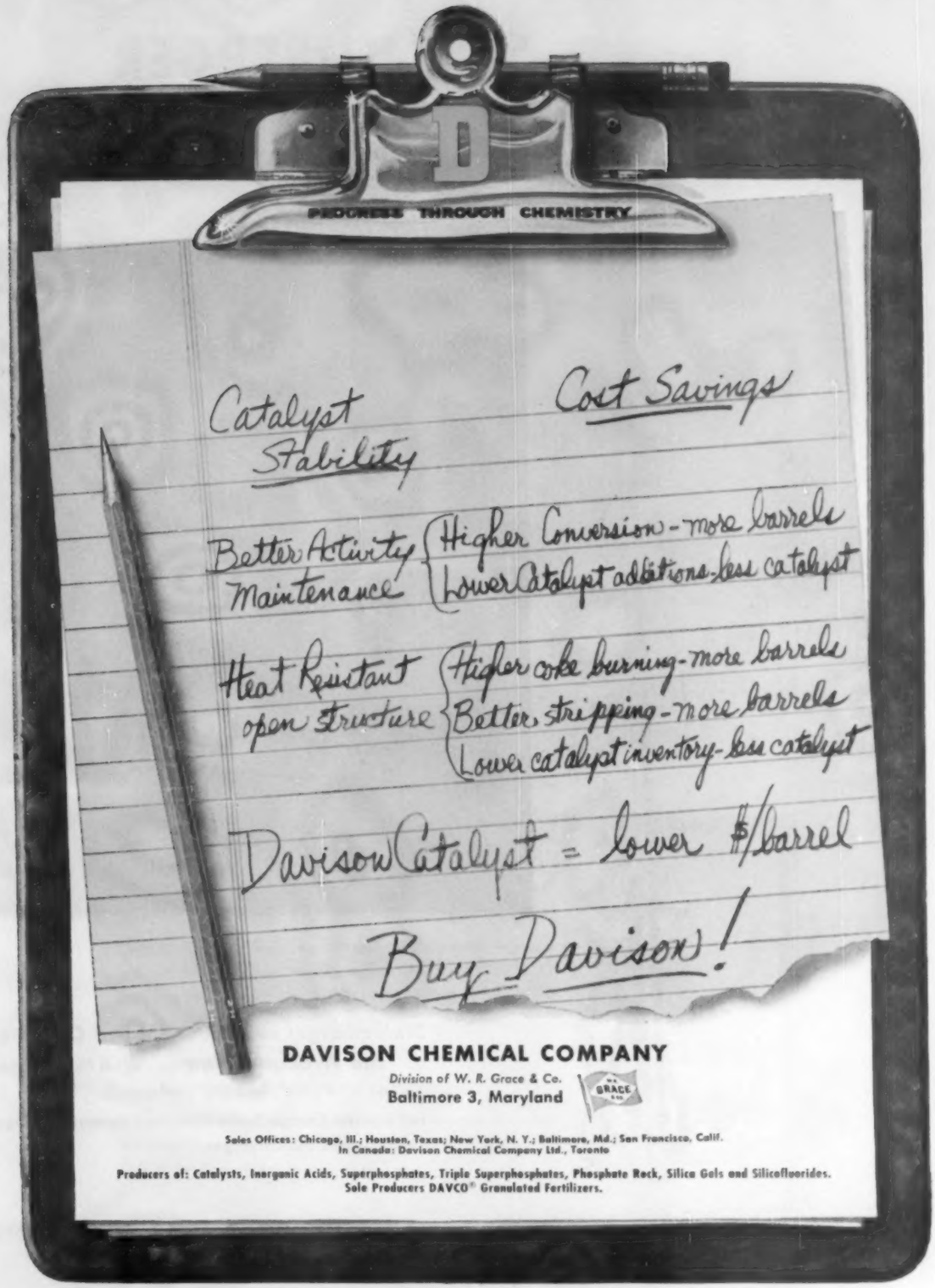

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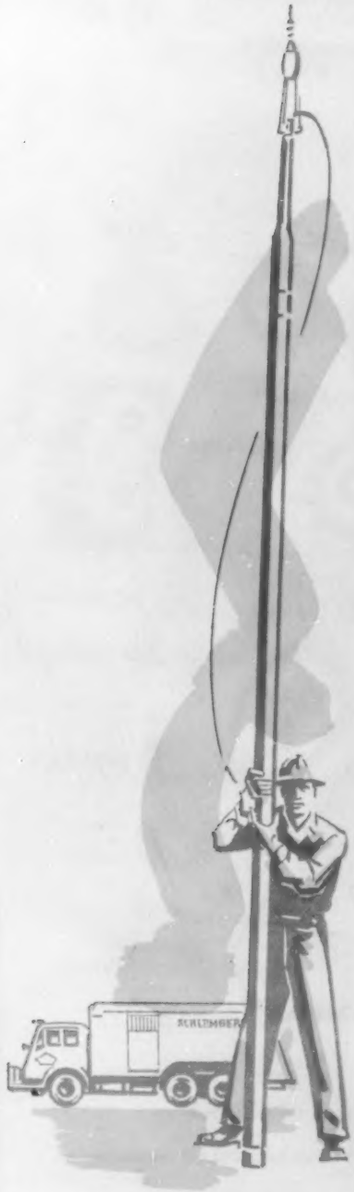

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For Shaped Charge Perforating that **Cannot be Plugged** — call Schlumberger.

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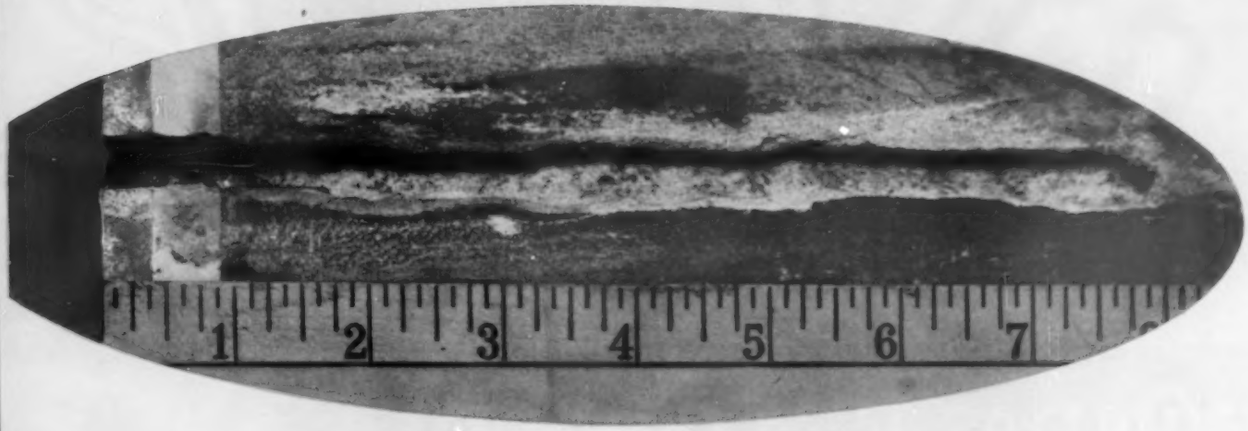
. . . a remarkable development in perforating

No-Plug 4" shaped charge fired in Berea sandstone target. Note excellent penetration and hole size.



THE NO-PLUG CHARGE MAKES A CLEAN HOLE . . .
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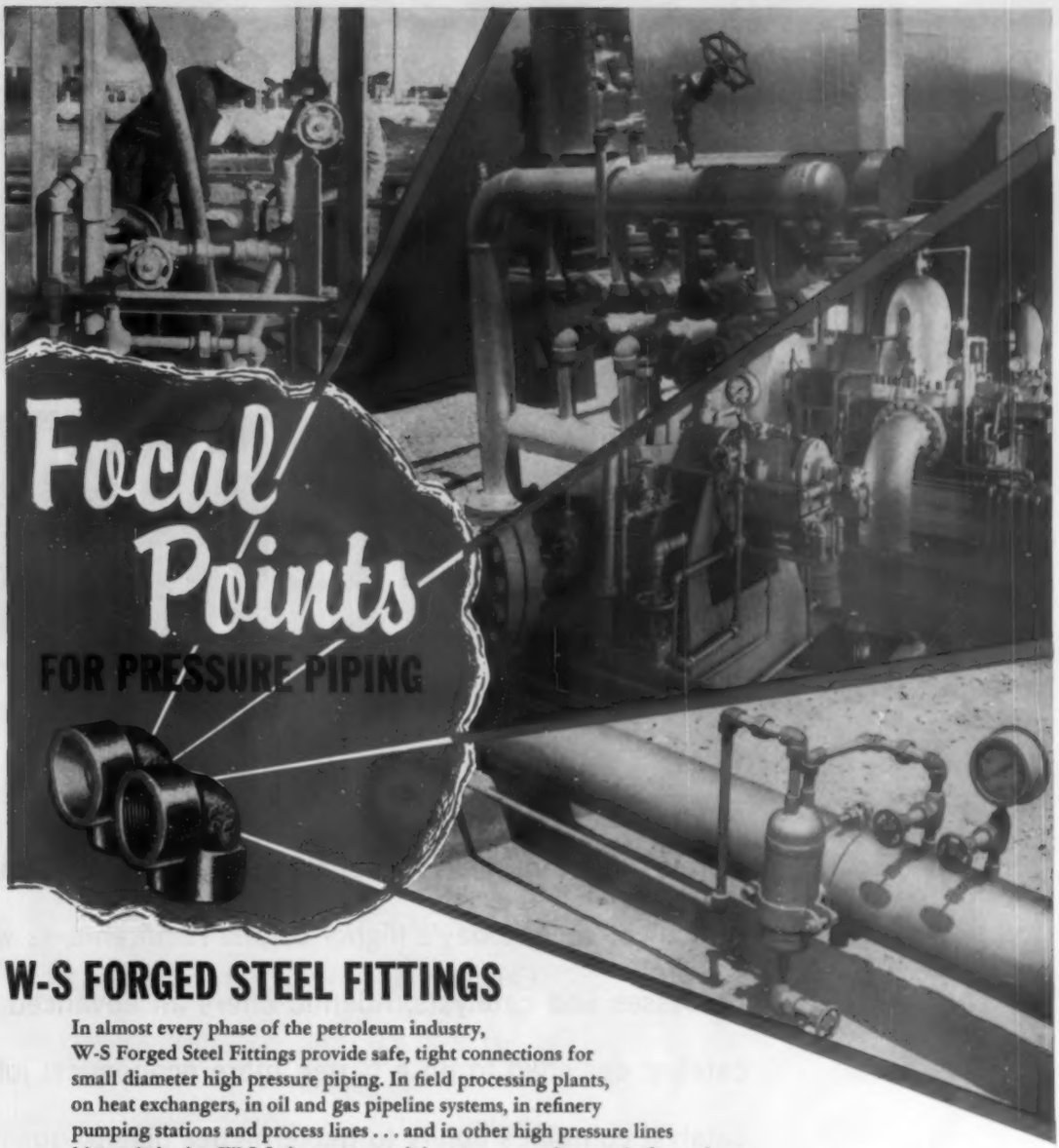

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In almost every phase of the petroleum industry, W-S Forged Steel Fittings provide safe, tight connections for small diameter high pressure piping. In field processing plants, on heat exchangers, in oil and gas pipeline systems, in refinery pumping stations and process lines . . . and in other high pressure lines 1/8" to 4" in size, W-S fittings protect piping systems against costly down time.

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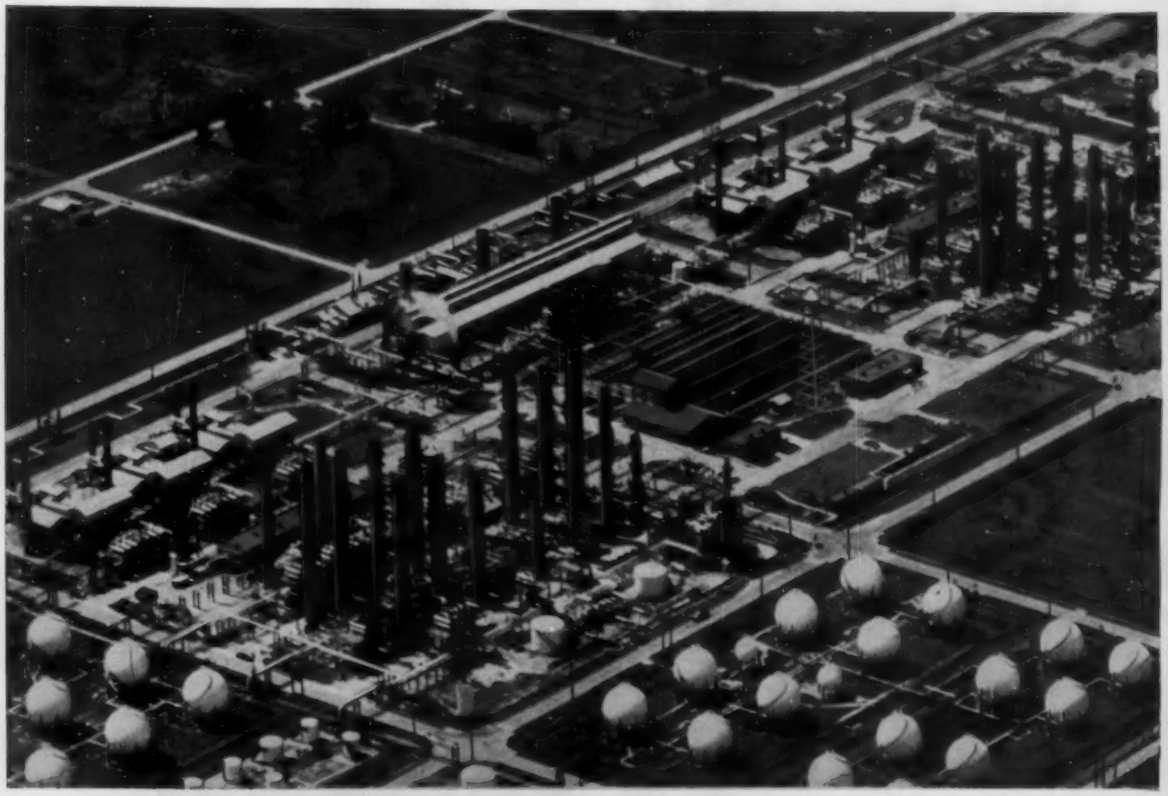
Port Neches expansion,



Present facilities of the world's largest Butadiene plant—the Port Neches plant of Neches Butane Products Company—will be augmented by Foster Wheeler to effect a 50% increase in total capacity.

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200,000 to 300,000 tons/year

by Foster Wheeler

FOSTER WHEELER CORPORATION will provide process and mechanical design, engineering and construction for the expansion program at the Port Neches Butadiene plant of the Neches Butane Products Company. The plant, recently purchased from the government, is jointly owned by the Texas-U.S. Chemical Company and Goodrich-Gulf Chemicals Inc.

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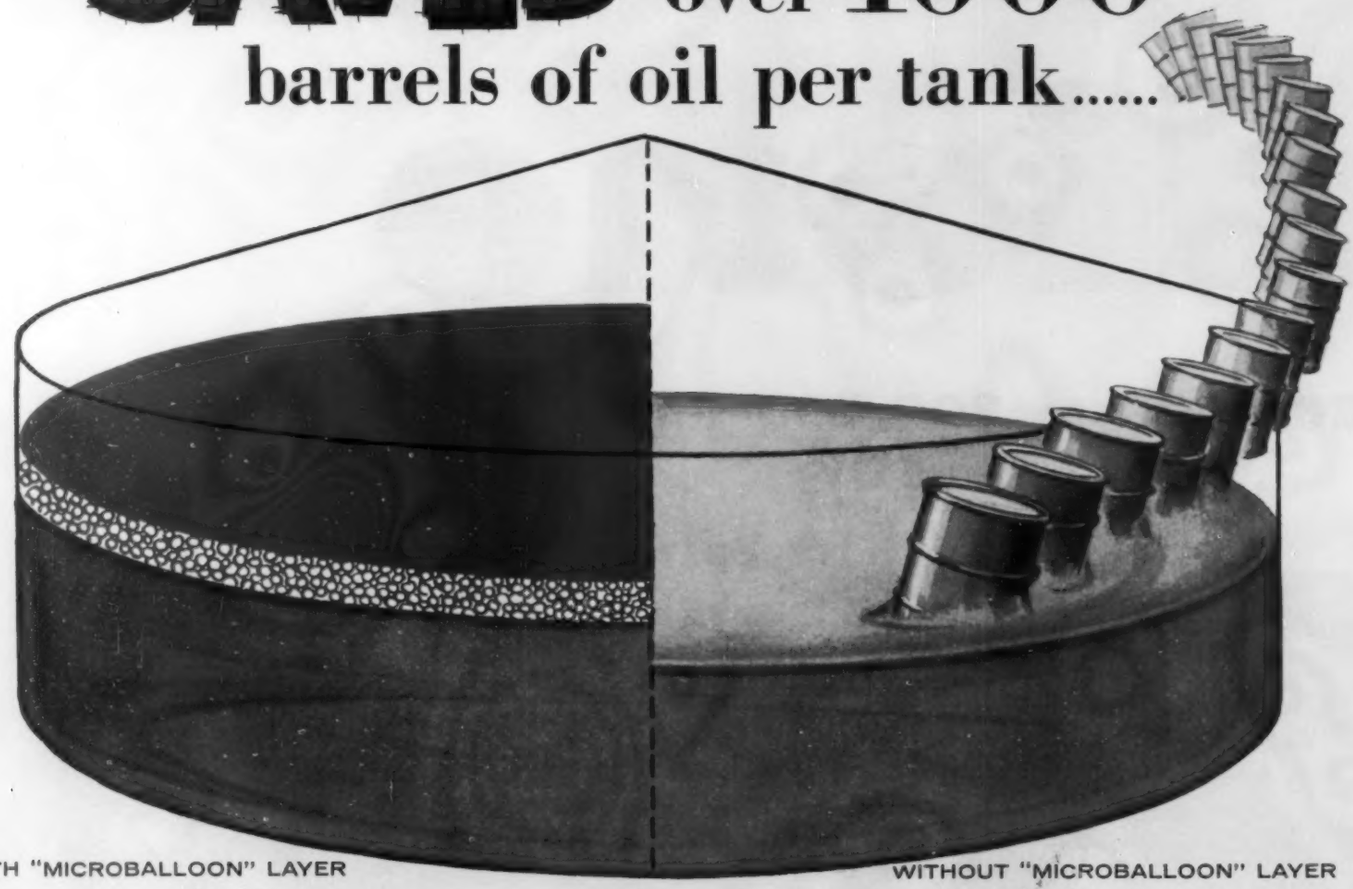

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The *Microballoon** Layer...Reduces Evaporation Loss

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"Microballoon" spheres are non-abrading, won't harm tanks, pipes or pumping equipment. Complete technical information is available in booklet form. Write today for your free copy of WP-11- "The Microballoon Layer Reduces Evaporation Loss".

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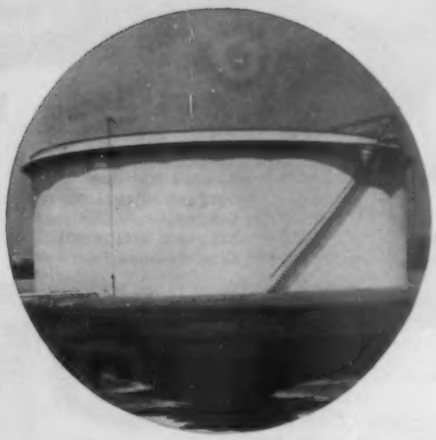

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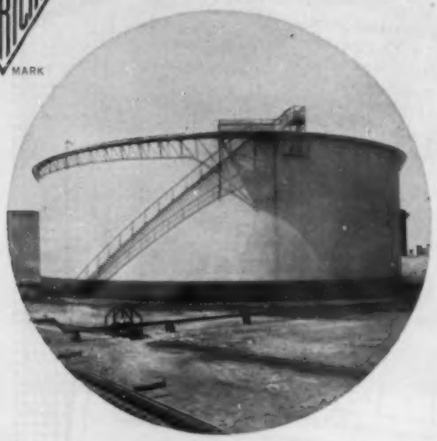

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148-DKBSU TURBODIESEL
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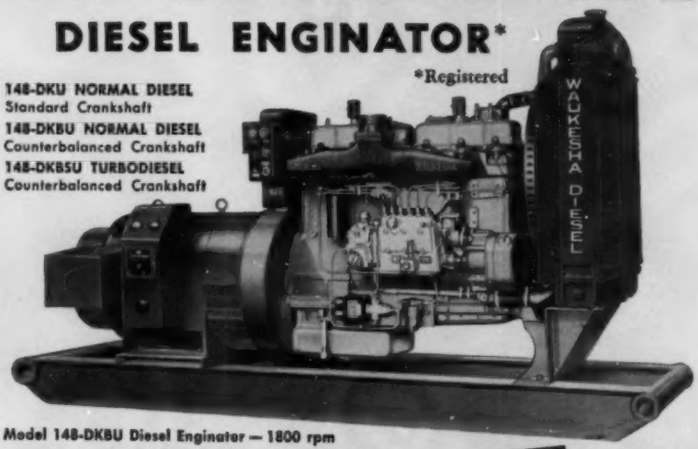

Model 148-DKBU Diesel Enginator — 1800 rpm

THE FIFTY-YEAR HISTORY

The fifty-year history of the Waukesha Motor Company almost parallels the first fifty years of this century. In 1906 internal combustion engines were hardly known outside of automobiles and motor boats. Now farming, roadbuilding, construction and contractors' machinery have developed around the internal combustion engine.

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1906 Waukesha Engines were first built

1908 Pioneered motor truck engines

1910 Farm tractor engines from the first

1915 First grain combines were Waukesha-powered

1917 World War I—powered the first "Liberty" army truck

1921 Combustion chamber and fuels research began

1923 Introduced internal combustion engines in oil fields

1924 Waukesha cylinder head design transforms industry

1926 Diesel engine research begins

1931 Waukesha ignition oil engine introduced

1935 First propane-engined railway air conditioning

1937 First cross-country bus air conditioning

1941 Millions of horsepower for all armed services

1946 High speed, heavy duty Diesels

1952 Application of turbo-charging to high speed Diesels

1953 New Laboratory and Research Center

1954 Introduction of 12-cylinder gas and diesel engines

1955 Diesel-Icer systems for refrigerator cars

1956 Continuous, progressive research and development

FOR STEADY, SMOOTH, DEPENDABLE AND ECONOMICAL SOURCE OF ELECTRIC ENERGY, the new Waukesha Industrial Enginators merit your serious consideration when new installations are planned or existing units are becoming obsolete and require replacement.

WAUKESHA ENGINATORS are the result of fifty years of success in designing and supplying heavy duty internal combustion engines and electrical equipment—to industry, agriculture, mining, transportation by road or rail. The Enginator unit is compact with single bearing generator and built-in vibration-proof instruments—no switchboard required. As Waukesha was a pioneer in the development of engines burning all commercial fuels, the new Waukesha Enginators may be had supplied with engines using diesel fuel, gasoline, LPG and artificial or natural gas and in capacities up to 600 KW. Capacity table of the 148 Series Diesel Enginators is shown below.

148 SERIES DIESEL ENGINATOR CAPACITIES—KILOWATTS**

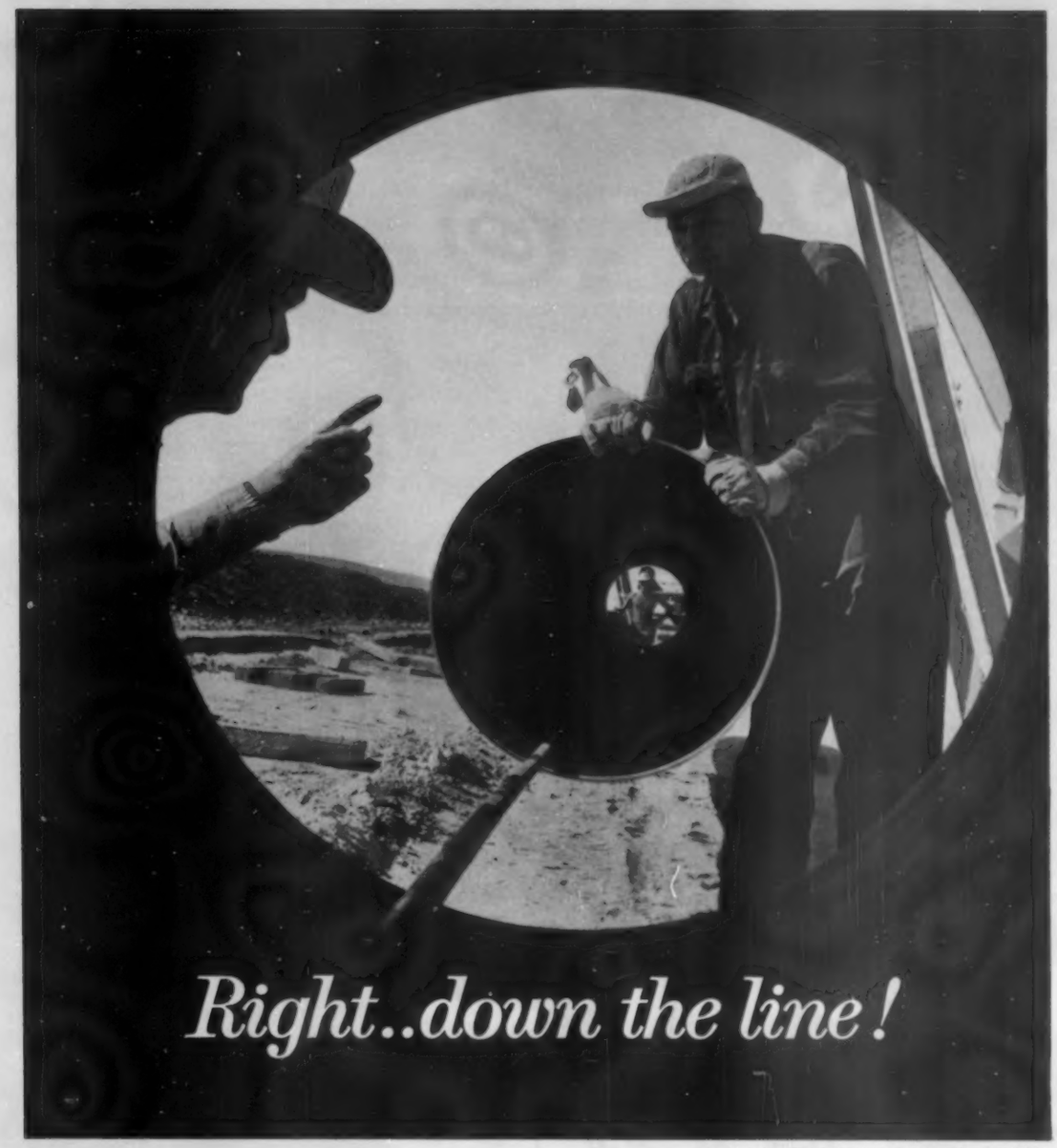
GENERATOR MODEL (by rpm rating)	ENGINE MODELS 148-DKU, 148-DKBU, 148-DKBSU								
	STAND-BY KW			INTERMITTENT KW			CONTINUOUS KW		
	148-DKU	148-DKBU	148-DKBSU	148-DKU	148-DKBU	148-DKBSU	148-DKU	148-DXBU	148-DKBSU
1800	*	115	150	*	100	135	*	90	120
1200	85	85	†	80	80	†	70	70	†
900	65	65	†	60	60	†	50	50	†

*148-DKU cannot be operated at 1800 rpm.
**Ratings are corrected to standard conditions 29.92 Hg. Barometer and 60° F. Air Temperature.
†Model 148-DKBSU not practical to operate at 900 and 1200 rpm.

Is your problem one of Stand-By, Intermittent Duty, or Continuous Duty? The above may give you all the information you require. For further details write to

Export Department

WAUKESHA MOTOR COMPANY
WAUKESHA, WISCONSIN



PACIFIC NORTHWEST PIPELINE CORPORATION PHOTOGRAPH.

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For example, Kaiser Steel Line Pipe—20 inch OD and larger—is placed in restraining dies and expanded by water under great pressure. This hydraulic expansion assures accurate diameter, concentricity and straightness—and also strengthens the pipe through additional cold working. Another example of the painstaking care that goes into the manufacture of pipe from Kaiser Steel.

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Kaiser Steel

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As the world's leading engineers and builders of petroleum refineries, The M. W. Kellogg Company is in a unique position to help oil companies work out the right answers. But the best place to begin is in the earliest planning stages—even before inquiry specifications are prepared.

If your company is in the $3 billion contest, we welcome the opportunity to help frame your refining problem and to assume complete responsibility for facilities—from process sequences through design, procurement, and construction, to an early on-stream date.

REFINERY PROCESS DIVISION

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single-screw, single-purpose oil tanker in service, has recently completed her trials.

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Photograph by courtesy of the builders, Vickers-Armstrongs (Shipbuilders) Ltd.

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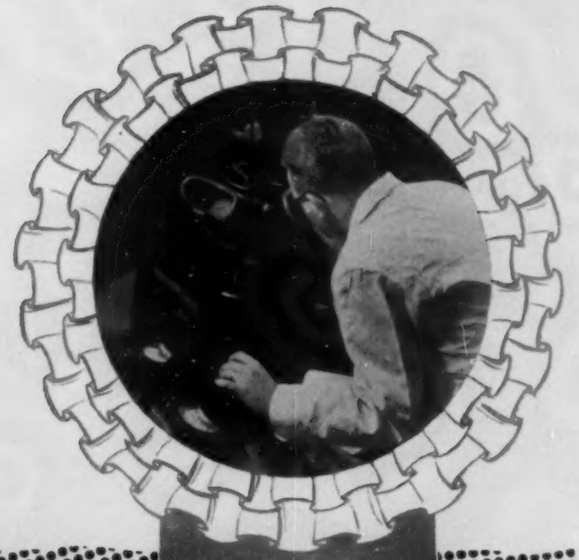

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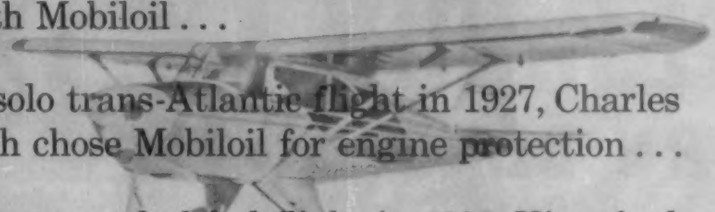

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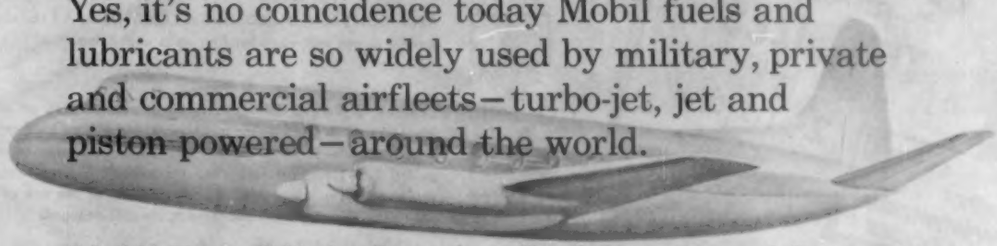

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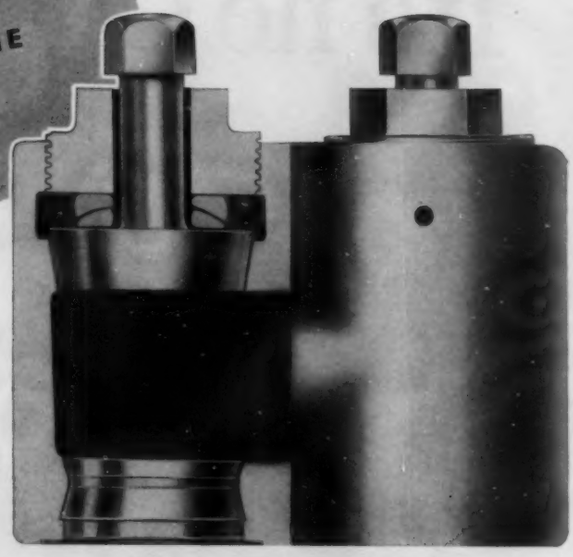

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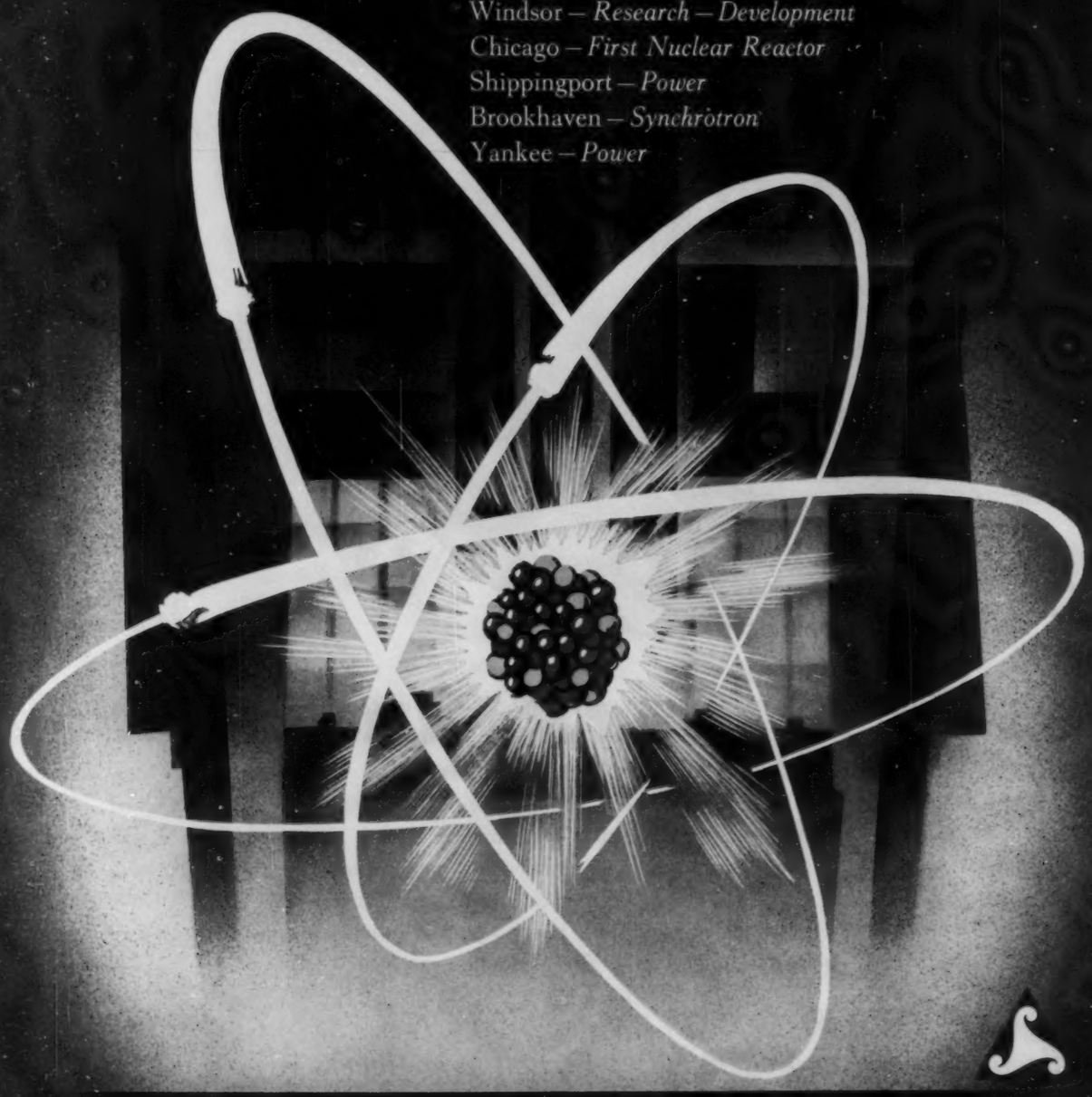

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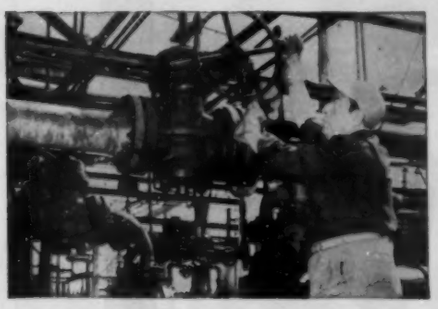

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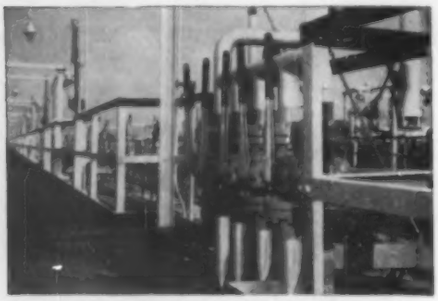

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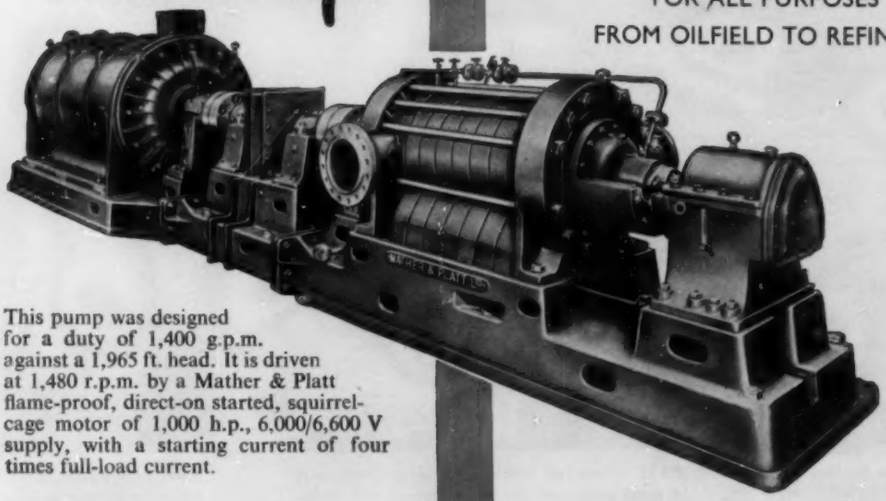

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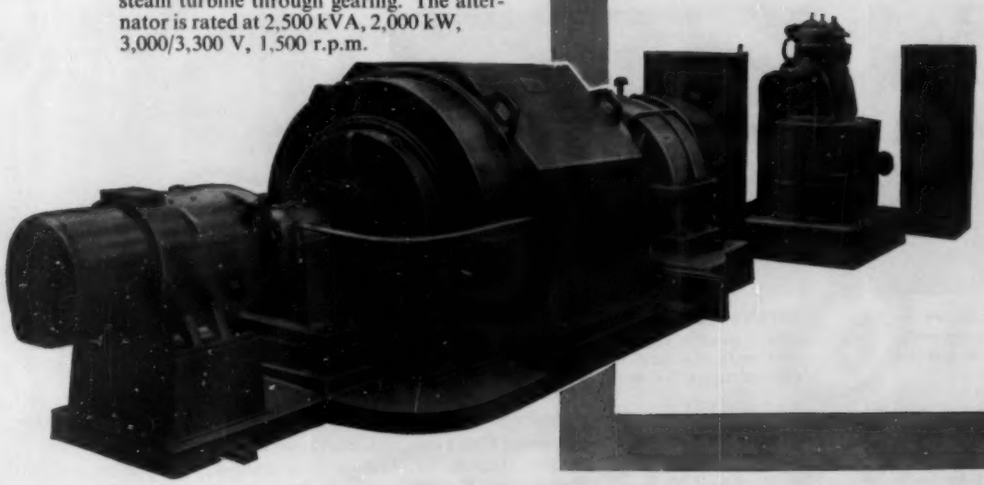

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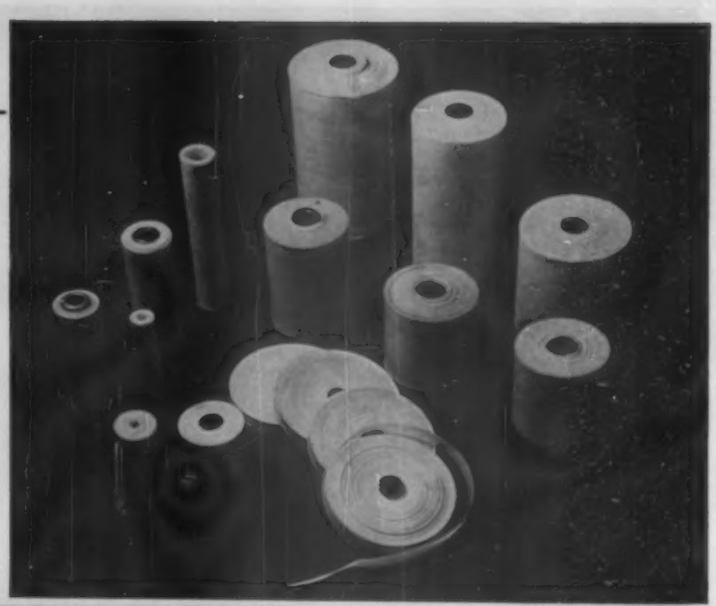

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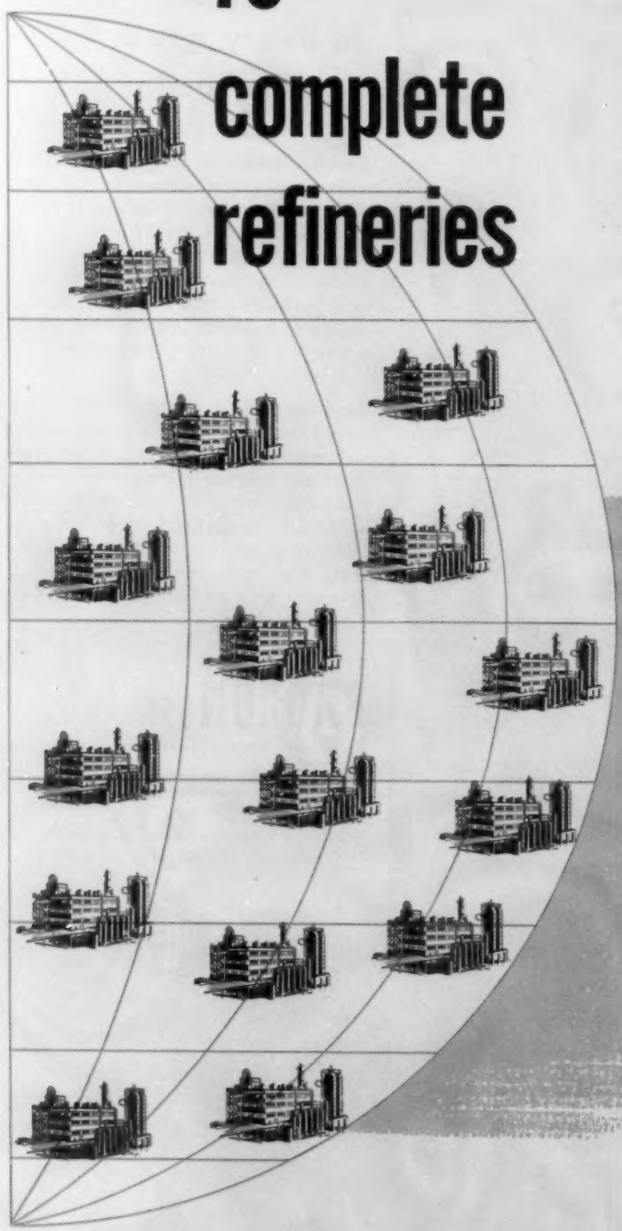

1945

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5. "Portable" refinery for U. S. Navy Department.
6. Lube oil refinery for Cit-Con Oil Corporation at Lake Charles, Louisiana.
7. Refinery for International Refineries Inc. at Wrenshall, Minnesota.
8. Refinery for Vacuum Oil Company Ltd. at Coryton, England.
9. Refinery for Burmah-Shell Oil Company at Bombay, India.
10. Refinery for Standard-Vacuum Oil Company at Bombay, India.
11. Refinery for Standard Oil Company (Indiana) at Mandan, North Dakota.
12. Refinery for Suntide Refining Company at Corpus Christi, Texas.
13. Refinery for Commonwealth Refining Company at Ponce, Puerto Rico.
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VOL. 27, NO. 12 NOVEMBER, 1956

World Petroleum

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CONTENTS

4 Washington Pipe Line, *by Joseph B. Huttlinger*
6 Canadian Notes
8 Latin American News
55 Challenges to Management, *by Frank M. Porter*
56 The Task Ahead, *by Jake L. Hamon*
57 A.P.I. Transportation Division Plays Vital Role in Industry
60 A Second Look at Australia, *by J. M. Wanenmacher*
61 Suez Spotlights Need For Oil Flow Guarantees
62 Iranian Wildcat Tamed
66 Iranian Operations Expand in Second Consortium Year
70 Northern Iranian Oil Potentials, *by Theodore Wild*
73 Russian Oil Equipment Salesmen are on the Road, *by G. G. Rosu and J. C. Chatfield*
76 Super Tanker Problem, *by Jack W. Hale and Herbert O'Connel*
80 Fractionation Research Pays Off
82 The Four Corners Area, *by Tom Dougherty*, Petroleum Information
87 World Crude Output Nearing 17 Million Barrels
88 Asphalt Opportunity, *by Glynn Harvey*
92 Acetic Acid and Anhydride, *by Peter W. Sherwood*
96 Westcoast Gas Line Construction Nearly Half Completed
98 New Dutch Oil Hopes
100 VHF Radio Installed on Sui Gas Line
108 Obsolescent Austrian Refineries Face Modernization Program
118 Review of U.S. Patents on Petrochemicals, *by Heinz Heinemann and Harold Shalit*
128 International News and Notes
134 Oil Company Staff Changes
138 London Letter, *by E. Lawson Lomax*
170 Advertisers Index

THIS MONTH'S COVER

Industrial design and power harmonize in this view of British American Oil Company Limited's Clarkson refinery. The company's golden anniversary came around this year. Company refineries now number five, compared with one in 1907. With its acquisition of Canadian Gulf Oil Company in 1955 the company's crude reserves are now 413 million barrels, plus 3,404,000 million cubic feet of gas. Daily production in 1956 is estimated to rise to 60,000 barrels covering 66% of the company's runs to stills compared with 32% last year. Color plates are reproduced through the courtesy of J. H. Yocum, manager of public relations for B-A.

FOCUS ON OIL

Wherever wheels turn or propellors spin or jets roar fire... the focus today is on oil. Oil... liquid energy... the earth's eighth sea... source of fuels and lubricants that give unprecedented mobility to modern life. But finding and recovering this dynamic fluid takes inspiration. Sober-minded competence. Willingness to sweat. Many a trick and talent with tools and equipment. Those are qualities you'll find to match your own in Halliburton's distinguished roster of well completion services. Six Halliburton services with one focus: oil. Six mutually reinforcing technologies backed by a generation of field-leading Halliburton research. Six corps of able, conscientious craftsmen loyally devoted to one cause: putting more and more oil in the tanks of every Halliburton customer.

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Challenges to management

By Frank M. Porter

(President, American Petroleum Institute)

In the months that lie ahead, oil industry management is going to be faced with a variety of challenges —some new, some old, some big, some small. A number of these are going to be of their own making—the inevitable results of internal tensions and basic disagreements. From a realistic point of view, these are healthy occurrences in a virile industry, for they underscore the rugged competitiveness of oil and oil men. But far too often they have unhappy aftermaths in that they provide further ammunition for the critics and others outside the industry who, for reasons of their own, would like to change petroleum's way of doing business. This thought should be borne in mind at all times by each and every member of the industry, particularly in the area of public utterances. Family squabbles are all right in themselves, but they should be confined to the household.

Probably the biggest over-all challenge that oil men face right now is the road back from the public opinion beating that petroleum took this year in the backlash of the presidential veto of the gas bill. This is a critical problem, and it is going to be even more difficult to overcome when criticism and controversy well up in the halls of Congress next year, as is bound to happen. Divorcement, depletion, imports, natural gas, jobber-dealer relationships, marketing controversies and similar items are sure to be on legislative agendas again in 1957. So oil men shouldn't let themselves be lulled into thinking that things are going to be any more peaceful and quiet along the Potomac than they have been in the past.

The ground that the industry lost in public favor and public understanding is appreciable. It is difficult to measure the exact extent, but that is secondary. The primary requirement is that it must be regained, and public confidence must be restored, if oil is to continue to operate under private management and competitive enterprise. Lack of trust or apathy on the part of the public can lead to restrictions and yokes that certainly will hamper and might even disrupt the magnificent supply network that oil men have created under the aegis of freedom and competition. That is why this challenge is so vastly significant and far-reaching right now.

This matter of improving public relations is not merely a job for the public relations departments either. It's a moral responsibility and an urgent necessity on the part of each and every oil man in the land. Professional public relations men are few, relatively speaking, and their efforts naturally are limited. But this is not a shortcoming. It is a grand opportunity for legitimate, cooperative action. If each and every oil man speaks up on behalf of his industry on each and every occasion possible, their swelling voices cannot help but have a profound impact and effect on the public.

Oil's record is good. Its character and citizenship are among the finest. It doesn't have to boast or beat its chest. The facts are dramatic and speak for themselves. All oil men have to do is serve as the vehicles to place them in evidence.

Oil men are used to challenges, for they are part and parcel of their work-a-day world. This one, however, is going to require extra effort and initiative by all. If it is tackled with the same vigor, courage and foresight that is traditionally displayed in their basic operations, the end-result can and should be a foregone conclusion.

To best serve the public with fine products at a reasonable price the industry must continue to encourage the growth of independent units and block restrictive threats from outside the industry.

THE TASK AHEAD

By Jake L. Hamon

Chairman, Board of Directors
American Petroleum Institute

As the API gathers in annual meeting at Chicago this year, I am reminded of something once written by a keen observer of our country and its customs:

"The Americans of all ages, all conditions and all dispositions constantly form associations. They have not only commerical and manufacturing companies in which all take part, but associations of a thousand other kinds—religious, moral, serious, futile, restricted, enormous, and diminutive . . . Wherever, at the head of some new undertaking, you see government in France, or a man of rank in England, in the United States you will be sure to find an association."

That comment came well over a hundred years ago from a brilliant student of humanity, Alexis de Tocqueville, in his famous book, "Democracy in America." As with so many other observations he made, the one quoted here still holds true today. At this moment, there are almost 9,000 trade, business, and professional associations in the United States.

It might be interesting to pause for a moment and see how the API, the trade association of the oil business, fits into this description.

I think we may immediately conclude, on the basis of our history, that we are neither a "futile" nor a "diminutive" organization. There might be some, too, who would question the word "religious," if applied to API. Yet one dictionary definition of the word "religious" is "scrupulously faithful or exact; conscientious." And by that standard, the word is more than apt for API and all of its works.

Certainly, API is a "moral" association in every sense of that sturdy, old-fashioned word. It is moral, in that it is "characterized by excellence in what pertains to practice or conduct." It is moral in the meaning of "right and proper." API is a moral association, also, in that it is "ethical; dealing or concerned with establishing principles of right and wrong in behavior." And we certainly, sometimes valiantly, strive to be a moral group in the sense of "conforming to a standard of what is good and right."

API is—still within the framework of de Tocqueville—a "serious association," for the dictionary defines that adjective as "being earnest; not jesting." This point, I am sure we'll all agree, needs no further elaboration.

As for our being a "restricted" association, the conclusion here must be a divided one. We are restricted, in that our membership is limited to members of the oil business, or to individuals or firms dealing with members of the oil business. We are, to use this dictionary definition, "restrained within bounds."

But the work we do, the contributions we make to our fellow citizens of the United States, cannot be termed "confined." Through the competitive efforts of API members, our industry contributes well over 2,500 material aids to the American standard of living. But we contribute something more, also. Through the working conditions of our physical plant, through the enlightened relations we enjoy with our employees, through the corporate benefactions of our companies, through the progressive—yes, and patriotic—thinking of oil industry leaders, we contribute tremendously to the civic, political, and spiritual standards which have helped lift American business, per se, to the position of world leadership it occupies today. In this, we are anything but a "restricted" association.

The final adjective from de Tocqueville, the word "enormous," certainly applies to the API and to the industry it represents—and I make that statement with no apology whatsoever. Webster defines the word as: "greatly exceeding the usual size, number, or degree . . . immense." And there is no gainsaying that the oil industry today is immense, by any standard.

Alarmists and self-anointed reformers claim to find cause for concern over this fact; "they see a dragon where there is no dragon." Big? Of course we're big. The job we have before us is big; it's immense. The efforts we exert to perform the job must be enormous. And—perhaps of this we should be proudest of all—the people within our industry are big, in every sense of the word. Whether they be a one-man operator of a service station in a tiny hamlet, or the board chairman of an international integrated company, few oil men have time to be mean or small.

To a certain extent, this may be due to the fact that we are the heirs of an environment of greatness. In the first days of petroleum, when men began to realize its potentials, our nation was still young, sometimes a little raw. The wildcatters then (and, in many respects, even so today) were part of a contest between earth and man, waiting hopefully, striving hugely, for the first taste of oil in the samples brought up by their drills. And, as in all ages of youth, it was good to be big, wonderful to be alive, fine and adventurous to draw tremendous resources from below the ground, and then to brag a little, perhaps even exaggerate a little, about what a whale of a job it was.

Eventually, as time went by, the folks in other businesses began to take notice of this phenomenon, and that's when the so-called jokes began circulating, which gave rise to the belief that every oilman was a multimillionaire.

The oil pioneers heard these jests and, with accustomed good nature, paid little heed. They smiled, and went about their business, making it a Homeric contest, filled with gusto.

Even today, the oil industry has an excitement about it that's hard to find in any other occupation. It's an old business, almost a century old, and it's conscious of its traditions. But it is conscious, also, of its responsibilities of living in a modern age; i.e., while proud of the rugged old-timers who laid its foundations, the industry has grown as the country has grown, until today we serve the nation in a mature, intelligent manner.

But under no circumstances must we let our past or our present delude us into assuming that we face a future without difficulties, without problems. We pride ourselves on being a progressive industry, and inherent in any progress are difficulties, problems, obstacles, to be surmounted, solved and overcome.

In the 12 months ahead of us, for example, I see as foremost among the major tasks facing our industry, the following:

★ To guard against continuing threats to initiative; particularly, I think, we must be on guard against renewed agitation over the percentage depletion provision;

★ We must, as an industry, encourage the healthy development of independent operators in every phase of our business: production, refining, transportation, and marketing;

★ We must eliminate the difficulties that block the path to industry unity; i.e., we must, I think, act together against common dangers and enemies—and this calls for closer, mutual cooperation between producers, service station operators, jobbers, refiners, and transporters;

★ We must be alert to the ever-widening peril of government domination—whether it be federal, state or local government;

★ We must continue, indeed even expand, the superb job we have been doing of supplying the public with outstanding products at reasonable prices;

★ But we also must continue, and expand, the job of telling the public of the contributions we make to its health, comfort, prosperity and security.

I have said that these tasks face us in the year ahead. Some of them will be with us for decades, such as, for example, telling the public of the work we are accomplishing.

This is particularly important, for we must always bear in mind that part of our job is to place before our fellow citizens the facts about the oil industry, and to place before them sufficient facts so that they will be convinced that the social and moral and ethical standards of our industry are high ones, standards of which we have every right to be proud.

A few paragraphs back, I mentioned that we should pride ourselves on the fact that our industry is a big one, big enough to do the big job ahead. We of the petroleum industry always have functioned with wide horizons; the scope of our efforts have been Gargantuan. They must continue so; it is our duty to see to it. For the end of our labors is, in the immortal words of our country's Constitution, to "provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity."

Toward these ends, as the API meets this month in Chicago, the modern petroleum industry of our country will continue to work, and in the working, perhaps give renewed vitality to de Tocqueville's observations that we are "religious . . . moral . . . serious . . . enormous . . ."

Because we are! And we glory in it. END

Transportation, one of the younger API divisions, has grown rapidly as complex problems have beset the management of pipe line, rail, marine, road transportation and communications. Liaison between industry and regulatory bodies is an important function as well as promotion of technical advances in the field.

API TRANSPORTATION DIVISION plays vital role in industry

No petroleum is refined or consumed without entering the complex transportation system employed by the industry. Oil makes use of every surface and subsurface facility and in remote regions even takes to the air to lubricate the wheels of industry, furnish power for its engines and heat and light for individuals.

Some idea of the size and complexity of the transportation task in the United States alone is gained from the following:

There are 186,000 miles of pipe lines in the United States.

Railroad tank cars totaling 122,000 carry petroleum products and petrochemicals to every corner of the land.

In the coastwise service some 500 tankers carry half a billion barrels of oil per year to market and many more tankers call at American ports in the export and import trade.

Inland rivers, barge canals and the Great Lakes are dotted with 2,000 barges carrying one-third of all freight on the inland waterway system.

On the highways 80,000 tank trucks deliver products to wholesale and retail stations and to the farm trade.

Serving the supply lines the petroleum industry makes use of more than 35,000 radio transmission certificates issued by the Federal Communications Commission.

Touching as it does the very grassroots of the country, from local towns through the nation's capital, a wide body of regulation has grown up around this phase of the oil industry; more perhaps than for any other oil sector. Regulatory agencies touch many facets particularly in the field of public safety and rates.

The government's interest in oil transportation created a need for a reliable information source completely familiar with the industry which could answer any question from those affecting military security to how to operate a pipe line. It created a need for industry representation commanding the respect of both government and industry and which could lend impartial help while avoiding involvement in destructive controversy.

In view of the importance of this task it is a source of satisfaction to all persons acquainted with the Washington oil scene that the Transportation Division of the American Petroleum Institute is doing the honest, careful job required.

Frank O. Prior, president of Standard Oil Co. (Ind.), Chicago, Ill., is API vice president for transportation.

James E. Moss, director of the division of transportation, American Petroleum Institute, Washington, D. C.

B. H. Lord, Jr., assistant director of the division of transportation, American Petroleum Institute, Washington, D. C.

Current vice president for transportation of the Institute is Frank O. Prior, president of Standard Oil Co. (Ind.). Mr. Prior was elected to his first term last November. His predecessors in this office, all of whom have contributed greatly to the growth and development of the division are: 1955-54—Charles S. Jones, president of Richfield Oil Corp., Los Angeles; 1953-52—P. C. Spencer, president of Sinclair Oil Corp., New York; 1951-50—T. E. Swigart, president of Shell Pipe Line Co., Houston, Tex.; 1949-48—W. Alton Jones, chairman of Cities Service Co., New York; 1947-46—B. Brewster Jennings, chairman of Socony Mobil Oil Co., New York.

Director of the Division of Transportation at Washington, D. C., is James E. Moss, who has been active in the division since it was organized in 1946. Location of divisional headquarters is in Washington, D. C. If the preferences of the Institute were to rule, the offices would be in New York, where its principal offices are located. But because oil transportation is regulated by various government agencies it was deemed expedient to have the division office in Washington, D. C. for convenience both to government and the industry.

The number of governmental agencies with which the division is concerned has grown at a staggering rate. Regulation in the field of tanker transporation alone is more than the entire body of Admiralty Law which has been accumulating for centuries.

Director Moss has a graphic and unique means of bringing this home to every Institute vice president who is newly heading the division. First, he arranges for at least two uninterrupted hours to brief him on the division's scope. He makes only one other request, that the briefing be in the company's board room. When the new vice president arrives, the board table is piled to a substantial depth with solid rows of books, committee records and statutes. Mr. Moss begins at one end; two hours and two sore feet later he lifts the last statute and tells what it applies to. It is an overwhelming experience for a person not familiar with the intricacies of government agencies, and it illustrates how delicate and vital is the role which the transportation division plays in safeguarding and representing the industry.

Important as Washington representation is, however, it represents only a part of the division's work which roughly corresponds in volume to the investment in its branches. The industry's pipe line investment totaling two and one-half billion is largest. It is followed by tankers with about two billion, tank trucks with a little under a billion, tank cars with $350 million and radio communication with perhaps $50 million. About a quarter of the Division's time is taken in answering a large number of questions about petroleum transportation. Around 100 every month come from high sources within the government and are basic and important. Their direction to the API illustrates the high regard the government has for the transportation division.

Diversified activities of the division are illustrated by the new School of Pipe Line Technology. Last month 25 miles east of Houston, on the campus of Lee College, Baytown, Texas, 30 "students" sat down in a class room and quitely began a highly specialized training program. Not all of the "students" were Americans either, some came from such places as Iran, Italy, Brazil, Venezuela and Canada, but all were mature and serious individuals, grown men whose poise and attitude reflected the stability and confidence of longtime exposure to business careers. One was an officer representing the U. S. Air Force.

With the exception of the officer they were pipe liners by trade—mostly supervisors. Early next month (December) they will "graduate," and thus share equal honors in being among the first to participate in the new School of Pipe Line Technology.

There is nothing startlingly new, of course, in oil men taking up specialized educational and vocational training programs. What makes this one different is that it's the first of its kind in the world, and it's the first such course to be sponsored by the Division of Transportation of the American Petroleum Institute.

Establishment of the school is a graphic illustration of the seven league strides in the growth and development of this key segment of the oil industry, and more particularly the far-sighted perspective as well as many varied activities of the Institute's Division of Transportation.

Currently, this division has an active membership of 1,483 individuals, but that's only a minor index of its value and worth. Its forums at the Institute's annual meetings are becoming increasingly popular and well-attended, because they move head-on into the areas of greatest topical interest for all transportation men. Its Pipe Line Technology Conference has grown so steadily that this year it took on new stature as an Annual Pipe Line Conference. Its corrosion and other activities similarly have kept pace in scope and enthusiasm. Its reputation and integrity are increasing, especially in the field of industry-government relations.

The Division of Transportation is somewhat of a paradox in Institute history. Its Central Committee on Railroad Transportation is the oldest committee of the Institute, yet the Division itself is, comparatively speaking, a fledgling. On January 1, it will be only 11 years of age. Other Divisions of the Institute—Production, Marketing and Refining—are much older, dating back to the early Thirties.

Since its formal organization in 1946, however, the Division of Transportation has been the focal point of all of the Institute's activities with respect to every form of transportation within the petroleum industry, from oil well to service station pump.

Its structural organization is typical of the other divisions. The General Committee, which has 65 members, is the ranking committee. The chairman of this group is the API Vice President for Transportation, and both he and the individual members are subject to annual election. API vice presidents, however, are limited to two one-year terms, while memberships of individuals can go on indefinitely provided they are elected.

Under the General Committee, there are five central committees, each of which is the highest committee authority in its particular field. The titles of these, in sequence of their creation in the Institute, are: central committee on Railroad Transportation; central committee on Highway Transportation; central committee on Pipe Line Transportation; central committee on Transportation by Water; and central committee on Radio Facilities.

Under each of these central committees, committees and subcommittees have been and are being established from time to time to deal with further sub-division of the problem. Typical of such committees are those on regulation, engineering, radio coordination, corrosion, pollution and so on.

Four of these central committees antedate the division while the fifth, that on radio facilities, came into being shortly after the division itself.

To put the whole operation into proper perspective, perhaps it would be best at this point to look back at the formation of the division, and the history of the central committees.

Prior to January 1, 1946, the date on which the division was born, there were about 30 API committees engaged in transportation activities. The work of these 30 committees was grouped under four principal headlines, as follows:

Railroad Transportation. This committee was appointed originally by the National Petroleum War Service Committee in the spring of 1918, as "The Advisory Committee on Tank Cars." It was organized for the specific purpose of securing prompt movement of tank cars in World War I—a major problem in those days too.

After the war, when the Institute assumed many of the activities of the National Petroleum War Service Committee, the Advisory Committee on Tank Cars became the General Committee on Railroad Transportation. Subsequently in 1930 under the divisional reorganization of activities the general committee became the standing Committee on Railroad Transportation of the Division of Marketing. It was transferred to the newly organized Division of Transportation in 1946 and now is called the Central Committee on Railroad Transportation.

Throughout its existence, this committee has been active in the consideration of important problems of common interest to the public, the railroads, and the petroleum industry.

Practically all of these problems relate to the safe, efficient, and economical use of tank cars and box cars in the transportation of petroleum and products. Specifically the

problems have usually arisen in connection with: ICC and AAR Specifications for Tank Cars; AAR Rules for Interchange of Traffic; ICC Regulations Governing Transportation of Flammable Liquids; AAR Rules for Demurrage and Storage; AAR Rules for Diversion and Reconsignment of Freight; AAR Rules for Mileage Allowance; Regulations of the Bureau of Explosives; and, Freight Classification Ratings, Rules and Regulations.

In cooperation with the Interstate Commerce Commission and the Association of American Railroads, the Institute's Central Committee on Railroad Transportation has made a substantial contribution to public safety and has accomplished great savings in time and cost to the industry in its transportation of petroleum and products by rail.

Highway Transportation. This committee was appointed originally in October, 1927, under authorization by the executive committee of the A.P.I. board in accordance with recommendation adopted at the transportation group sessions held in Tulsa, December 8, 1926. It was then known as the General Committee on Automotive Transportation. In 1930, the committee was divided into two divisional standing committees which were subsequently united again to form the Central Committee on Automotive Transportation. Effective January 1, 1953, the name was changed to Central Committee on Highway Transportation.

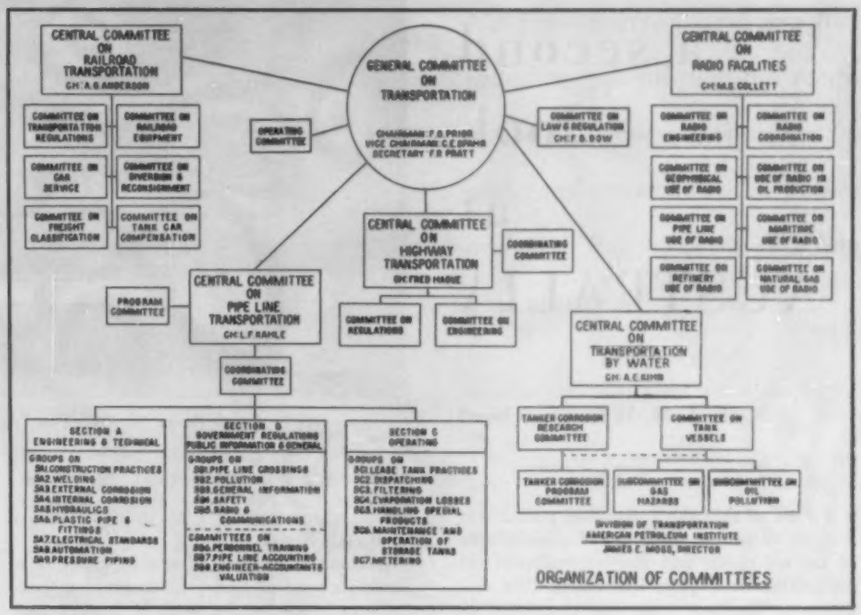
The immediate objective for which this committee was organized was the consideration of the National Fire Protection Association's Recommended Good Practice for the Construction and Operation of Automobile Gasoline Tank Trucks. This has continued to be an important subject to the committee because, in revised form, the NFPA Suggested Ordinance on Tank Trucks has become an API Standard and has been used as the basis for ICC specifications for vehicle tanks to be used in the transportation of flammable liquids via highway.

Other activities of the central committee relate to technical subjects such as: Flow Tests on Truck Tank Discharge Piping; Truck Chassis Dimensions; Weights and Measures Regulation on Vehicle Tanks; Regulation of Truck Weights and Sizes; and ICC Regulations Governing Transportation of Flammable Liquids, Truck brakes, etc.

Pipe Line Transportation. This committee was authorized in 1932 to provide an organized section in the Production Division where problems affecting this group could be given adequate consideration.

The committee succeeded to and took over previous technical studies of corrosion of pipe lines which are included under the immediate direction of a group of pipe line technologists. It supervises all Institute activities in connection with pipe line transportation of crude oil and refined products.

The committee is cooperating with the Interstate Commerce Commission on the valuation of pipe lines through the Committee on Valuation of Pipe Lines and it acts as a clearing house on accounting problems arising from the administration of the Interstate Commerce Commission Accounting Regulations which is done through the Committee on Accounting Regulations.


CENTRAL COMMITTEE ON RAILROAD TRANSPORTATION
GENERAL COMMITTEE ON TRANSPORTATION
CENTRAL COMMITTEE ON RADIO FACILITIES
CENTRAL COMMITTEE ON HIGHWAY TRANSPORTATION
CENTRAL COMMITTEE ON PIPE LINE TRANSPORTATION
CENTRAL COMMITTEE ON TRANSPORTATION BY WATER
ORGANIZATION OF COMMITTEES

It also sponsors special studies affecting pipe line transportation such as corrosion and cathodic protection, hydraulics, welding, and construction practices, and sponsors mid year meetings on pipe line problems.

Transportation by Water. This committee originally was appointed in 1934 as authorized by the executive committee. It was first called the Central Committee on Tanker and Barge Transportation.

The activities of the central committee have included four subjects, namely, regulation, corrosion, pollution and gas hazards.

Through its Committee on Tank Vessels the Central Committee has cooperated actively with the Department of Commerce (and during the war and since with the U. S. Coast Guard) in the preparation and amendment of the General Rules and Regulations for Tank Vessels. Through its Tanker Corrosion Research Committee it provides a medium for the cooperative study of corrosion problems of mutual interest. Through its Committee on Gas Hazards it cooperates with the American Bureau of Shipping on subjects relating to hazards from gases. Through its Committee on Pollution it assists government agencies in oil pollution problems.

The cooperative work on rules for tank vessels has resulted in great savings and other benefits to the industry.

The Central Committee on Radio Facilities was established in the Division of Transportation as the result of recommendations made to the General Committee of the Division. The General Committee approved these recommendations and so reported to the Board of Directors. The Board authorized the formation of the committee on April 23, 1947, and a temporary committee was appointed a few days later. The first permanent Central Committee on Radio Facilities was appointed on September 4, 1947, and the committee met for the first time on November 9, 1947, in Chicago.

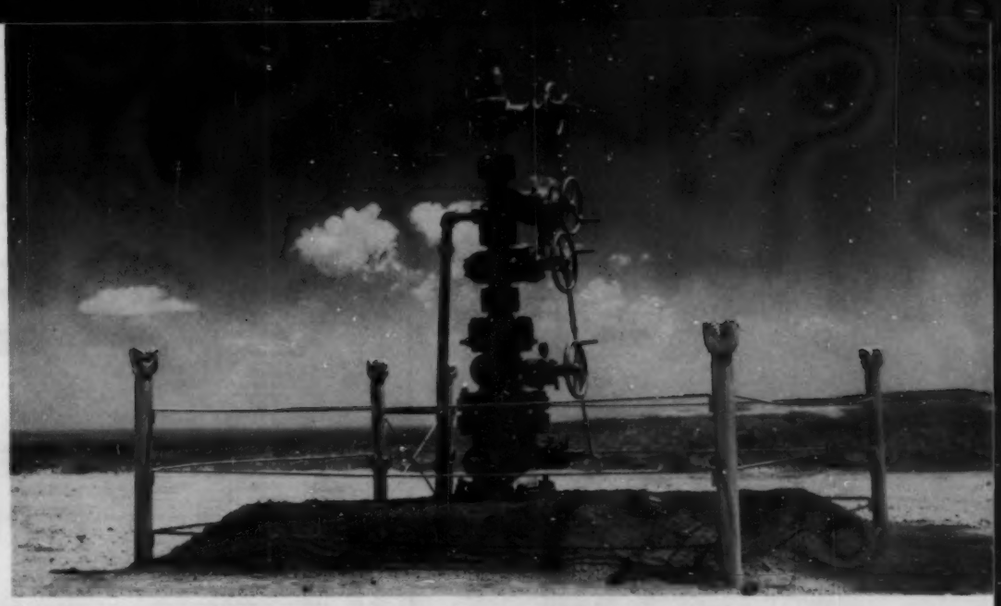
The committee cooperates closely with the Federal Communications Commission in matters relating to the use of radio by the petroleum industry where such matters are of industry-wide concern. Radio is extensively used by the petroleum industry in geophysical work, oil production, pipe line operation, truck dispatching, and ship, tug and barge operations. Through its Committee on Radio Coordination, cooperative relations are maintained with the American Gas Association and the National Petroleum Radio Frequency Coordinating Association.

Headquarters of the Transportation Division are located in Washington, D. C. The facilities are modest indeed, just enough to house the director, the assistant director and the small staff necessary to handle the division's affairs. In addition, it has a conference room which also doubles as a library.

The library was started at the time the division was set up. An effort is being made now to assemble all of the congressional reports on petroleum and its transportation, as well as government regulations and publications on the same subject. So far the library has been most helpful to the committees, and to students.

The prospects ahead for the Division of Transportation are bright indeed. And as the new School of Pipe Line Technology indicates, the men of transportation are preparing for the future with all the skill at their command. END

a second look at AUSTRALIA



Christmas tree on Rough Range No. 1A. (Photo by Philip Martin for California Texas Oil Co.)

By J. M. Wanenmacher*

IN June of 1954 the Australian public was quite enthused about the oil possibilities of the continent and the international oil companies were quite interested. This enthusiasm resulted from the discovery of commercial amounts of good quality oil during a drill steam test, Western Australian Petroleum (Caltex and Ampol) Rough Range No. 1, of a Cretaceous sand at an approximate depth of 3,600 feet in December, 1953.

During 1954 and 1955 approximately 90 oil concessions were granted in Australia. Considerable funds were raised in Australia through public offerings to explore for oil. Considerable exploration in the form of wildcat drilling was conducted by these Australian companies. Western Australia Petroleum Co. conducted an exploratory program involving 12 exploratory wells.

The original well at Rough Range was abandoned for mechanical reasons at a depth of 14,602 feet after encountering traces of oil and showings of gas in Permian beds at a depth of about 10,000 feet.

Seven additional tests were drilled in the vicinity of Rough Range No. 1 to test the Cretaceous sand and all found it barren until a twin was drilled to the No. 1 well. It was completed in the Cretaceous sand with an initial daily production of 400 barrels daily flowing through ¼-inch choke. In addition to the tests at Rough Range, Western Australian Petroleum completed two deep dry holes and several stratigraphic tests in the Salt Marsh area south of Rough Range. Two dry holes have been drilled at Cape Range north of Rough Range.

Two deep dry holes have been completed in the Frasier river area of Western Australia, approximately 1,000 miles northeast of Rough Range.

Across the country, other companies have drilled a total of 15 dry holes ranging from 3,200 to 10,000 feet in depth in Queensland. A gas well has been completed near Roma where the presence of gas had been known for many years. Two of the tests were near Maryborough, one was near Brisbane and the remainder was drilled in the central part of Queensland. Other developments include a dry hole near Sydney and another in the Gippaland area of Victoria.

Santos Oil has drilled several core holes on its Wilkatana prospect in South Australia. These have encountered oil showings in Tertiary sandstones and underlying Cambrian limestones. The Cambrian beds are believed to be the source of the oil. To date no production tests have been made of these showings.

Santos Ltd., a small Australian prospecting company formed in 1954 considers that the Cambrian limestones in Australia have the greatest potential as source beds of importance and has repeatedly found oil traces in its Wilkatana drills, near Port Augusta in South Australia. In this area a South Australian government geological survey has also recently come across similar oil traces. Santos has to date put down 13 core holes with light-fraction traces in several of them. In the No. 1 well traces of light honey-colored paraffin-based crude were first observed in early Tertiary sands carrying artestian waters. In May the company obtained the first verified recovery of liquid as apart from very light fraction crude oil, in South Australia. This was a medium-heavy aromatic paraffinic crude oil recovered from depths below 1,001 feet in Cambrian limestone both in flush waters and in core sections. In mid-August Well No. 13 below 543 feet in lightly consolidated Tertiary sands showed an "abundance of oil films and globules exhibiting lively yellow and blue fluorescence." Drilling is continuing with geological mapping of adjacent Cambrian formations along the west of the Flinders range. Santos is currently raising £112,500 new capital to prospect, which will lift capital to about $490,000.

Showings of oil were recently obtained in the same Cambrian limestone while drilling a water bore in Northern Territory near the Queensland border. These results have aroused considerable interest in the possibility of oil production from the Cambrian limestone which is present throughout a large area in South Australia and Northern Territory.

In summary, the record since discovery of oil at Rough Range in December of 1953 has been one oil well, one gas well and 30 dry holes. Much of the exploration was undertaken with excellent geological supervision. The wells were drilled by modern methods and in almost all instances competent observers were present for the detection of oil and gas and to supervise the testing of showings.

The results have been discouraging and at the present time activity is virtually at a standstill. Western Australian Petroleum is conducting a limited amount of structure drilling in the extreme western part of the continent. Santos Oil, Ltd. is continuing its core drilling in South Australia.

The prospects of activity in the near future are rather dim. The major oil companies have lost interest. Many of the concessions have been surrendered. The Australian public has lost its enthusiasm for oil shares. Most of the Australian companies have expended their funds and the prospect of obtaining the capital necessary for exploration by additional public offerings or calling upon stockholders for additional funds is very poor at this time.

The Australians have a substantial gambling spirit. They are extremely interested in horse races and nation-wide lotteries are in continuous operation. The present low ebb of enthusiasm would be quickly reversed if a commercial oil field was discovered. However, without a single wildcat drilling there is little prospect of a discovery in the near future.

It is the writer's opinion that commercial amounts of oil will be discovered in Australia. The deposits will be hard to find and the prospect of finding them in the next few years is remote because of the limited amount of exploration expected. END

** The writer, a partner in the firm of Keplinger and Wanenmacher of Tulsa, Oklahoma, visited Australia in April and May of 1954 to examine certain oil concessions. Shortly thereafter an article appeared in World Petroleum, October 1954 entitled "Australian Oil and Gas Possibilities" by J. M. Wanenmacher and C. H. Keplinger. In June and July 1956 the writer again visited Australia for a period of five weeks during which he examined oil concessions in Queensland and South Australia. The purpose of this brief article is to review developments in the intervening period and discuss the present status of the search for oil in Australia.*

Suez Spotlights Need for Oil Flow Guarantees

Nationalization of Suez has failed to halt oil flow but confidence of shippers was shaken by unilateral action and a big tanker and pipe line building program is in prospect.

NATIONALIZATION of Suez has brought into the public-eye two vital concepts which were less appreciated before. The first of these is the tremendous growth in European (and world) petroleum demand.

Stressing the growing needs of Europe, a recent report by the O.E.E.C. (Organization for European Economic Cooperation) raised previous estimates considerably and in one paragraph the report said, "To satisfy its future energy needs Europe will increasingly depend on the importation of Middle East oil. The forecasts in this report assume the ample and uninterrupted availability of Middle East oil. At the same time the vastly expanding European market will provide the Middle East oil producing and transit countries with the income necessary for their economic development and the achievement of an enduring improvement in their standard of living. The future prosperity of the consuming countries of Europe and that of the oil producing and transit countries of the Middle East are thus inextricably linked and their rapid and healthy economic progress depends on continued unimpeded exchange of resources."

The need of U.S. protection has led President Eisenhower to request the development of tentative plans for a fleet of super tankers to be built. Based on the long-range viewpoint that the United States should not be allowed to get into a position of dependence on Suez, the Office of Defense Mobilization, headed by Dr. Flemming, is studying construction of some 50 tankers. Oil company shipping programs also envisage the construction of more supertankers to ensure maximum flexibility.

Western dependence on the Middle East is, of course, based on faith in contracts. In view of the fact that the Suez Canal has not been closed, and is taking a normal amount of traffic, the primary importance of the nationalization lies in the one-sided rupture of a contract. The nations of Europe cannot convert their economies wholeheartedly to dependence upon oil unless they are assured of a constant supply, not subject to interruption.

The interdependence and mutual confidence were recognized by Walter J. Levy, internationally known oil economist and consultant, in a paper delivered before the latest World Petroleum Congress in Rome.[1] Mr. Levy defined the considerations which must guide the various participants in the world's oil economy as (a) recognition of their interdependence; (b) understanding of need for an equitable relationship between them; (c) awareness that not only their own vital interests but those of others are involved; and (d) the acknowledgment that each must take into account the effects of his actions on others and be willing to limit his political, economic or legal power accordingly. He added a final note on the possible use of force if these considerations are ignored, and summed up in saying "each of the participants must accept freely as his guiding and limiting consideration the pursuit of his enlightened self-interest based on their recognition of mutual interdependence and founded on the respect for his own obligations and the basic rights of others."

As mentioned previously, the Egyptians have thus far kept traffic flowing through the Canal without serious delay. In his recent debates before the United Nations, the Egyptian representative pointed out that during the first months since nationalization an average of 41 ships per day has passed through the Canal. The total for one day approached 60, which is much higher than normal and a near-record.

The number of pilots continues to grow as well. British and French pilots numbered 205 before the nationalization. In his speech before the United Nations during mid-September, the Egyptian representative stated these have been replaced by 188 other pilots. There were 10 Americans listed in the group. These are outnumbered by the Russians, totaling 16. Egyptians totaled 80. Among the other pilots are 24 Greeks, 14 Germans, 7 Italians, 5 Norwegians, 11 Yugoslavs, 3 Spanish, 11 Polish, 2 Swedish, 2 Dutch, 2 Romanians, one South African and one Hungarian.

The possible interruption of oil supplies, however, caused many countries to look closely at their petroleum stocks. An example is Belgium, where the Suez crisis and possible delays in delivery of crude oil from the Middle East to the huge Antwerp refineries have so far failed to arouse undue anxiety in authoritative circles due to the fact that the country has always had four months of oil and gasoline reserves. Moreover, since supplies from other petroleum producing areas will continue, this reserve should ensure the country's needs for a long time to come.

The Middle East situation has nevertheless served to stress the changeover of Belgium from a major coal-consuming country, in the past years, to a major consumer of petroleum. This is due not only to the increase in automobile and truck transport but the rapidly increasing use of fuel oils for central heating and industrial uses.

The Belgian merchant navy alone has so completely adopted the use of fuel and gas oil that only some 10% of the more modern vessels remain coal-powered and these too are undergoing rapid reconversion. In industry, petroleum is overtaking the use of coal and this tendency will in all probability be continued as the lack of coal and possible unofficial rationing make themselves felt this coming winter.

Imports of crude oil, for refinery, home consumption and export purposes, in Belgium, have doubled since 1952.

In that year, some 2,280,600 tons of crude petroleum were imported. This figure rose, in 1953, to 2,933,000 tons, in 1954 to 3,730,000 and last year to 4,711,600 tons (about 94,232 b/d).

Light industrial oils and petroleum were imported by Belgium and Luxembourg: 1954—14,900 tons (298 b/d) and 15,300 tons (306 b/d) in 1955, all for home consumption.

Consumption of kerosine alone declined over the past 12 months with imports falling from the 55,000-ton mark in 1954 to 29,400 tons (588 b/d) last year.

The great increase has been in fuel oils and gas oil. Here official government figures, just released, give the following fuel oil imports: 1953, 761,300 tons; 1954, 899,700 tons; 1955, 1,040,600 tons (20,812 b/d). Gas oil imports by years are as follows: 1953, 479,600 tons; 1954, 503,900 tons; 1955, 691,600 tons (13,832 b/d).

Total Belgium and Luxembourg imports of crude petroleum, light industrial oils and petroleum for other than industrial uses, kerosine, fuel oils and gas oil will, it is expected, exceed 8,000,000 tons (160,000 b/d) this year as against 6,886,100 tons imported in 1955. The increase in consumption of special by-products of the petroleum industry, such as LPGas, continued to increase, reaching some 135,000 tons this year.

(*Continued on page 116*)

1. Interdependence as the Foundation for World Oil Development—by Walter J. Levy. Proceedings of the Fourth World Petroleum Congress, Section IX/B.

IRANIAN WILD WELL TAMED

Alborz No. 5 near Qum, Iran, flowing wild at 80,000 to 100,000 b/d was brought under control without catching fire under direction of Myron Kinley.

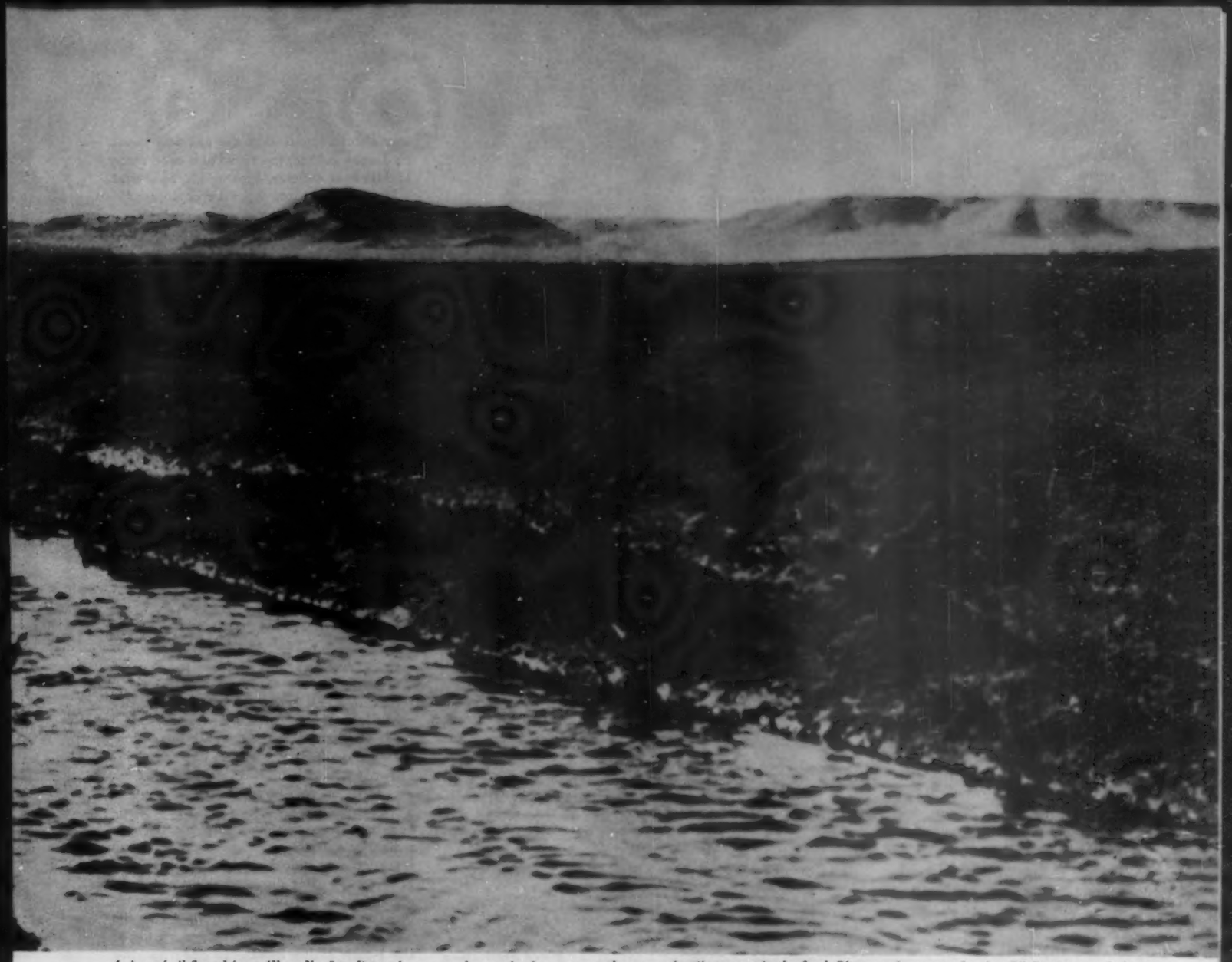
EXPLORATION work on the Alborz structure in northern Iran which has been in progress since 1950 appears to have been rewarded by the discovery of a major new field. Coming in wild at 80,000 to 100,000 b/d the well still was producing more than 10,000 b/d when choked back under partial control at a wellhead pressure of about 3,200 psi.

The Iran Oil Co., an Iranian government agency, now a subsidiary of the National Iranian Oil Co., has been carrying out geological and geophysical exploration work, together with the drilling of test wells in northern and central Iran for some years.

Most of the drilling effort has been concentrated on the Alborz structure near the town of Qum and some 80 miles south southwest of Teheran.

The Iran Oil Co. was organized in 1949, before the nationalization of the Iranian Oil industry, for the exploration of possible oil deposits in the large area of Iran outside the limits of the former Anglo Iranian Oil Co. concession area. F. Naficy was the first managing director, and on his joining the board of the National Iranian Oil Co. was succeeded by the technical director of the company, B. Mostofi, in February 1953 as managing director, but Mr. Naficy retained his position as chairman.

Work in the Qum area commenced in 1950 and the Alborz structure was chosen for the location of the first test well. The Alborz structure is an anticline some 30 miles long and 10 to 12 miles wide, having two main domes at the surface with the outcropping rocks consisting of the upper



A river of oil flowed from Alborz No. 5 to distant low spots where embankments were thrown up hastily to contain the flood. Photograph courtesy Iranian Oil Participants Ltd.

red series of Upper Miocene age. The prospective reservoir rock is a limestone of Oligo-Miocene age, equivalent to the prolific Asmari limestone of Southern Iran. The well known salt plug of Kuh-i-Namak is situated on the western plunge of the anticline.

Details of the geology of the area were given in two papers presented to the Fourth World Petroleum Congress held in Rome in 1955. The papers are entitled "New Aspects of the Geology in Central Iran," by A. Gansser, chief geologist, and "The Oligo-Miocene Marine Formation in the Qum Region (Central Iran)", by M. A. Furrer and P. A. Soder, palaeontologists of the company.

The drilling of the evaporite series proved to be an obstacle to a successful well completion and no less than four holes had to be abandoned owing to mechanical difficulties, in this series, and the main limestone was never reached.

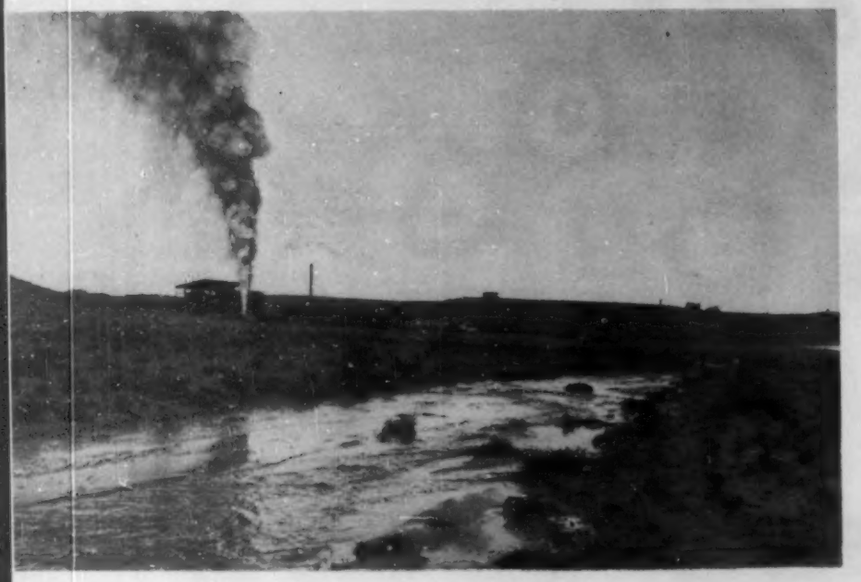
Alborz No. 5 also had its difficulties in drilling this plastic evaporite series, there were numerous fishing jobs and two lots of fish were successfully sidetracked before the evaporite series of limestone penetrated, when the bit appeared to drill into a fractured zone and the well unexpectedly blew in during the early hours of August 26, 1956.

The well was being drilled under contract by Drilling and Exploration Inc., Los Angeles. A National type 100 rig powered by Superior Diesel Engines was used and a mud weight of 128 to 133 lbs. per foot had to be carried to drill the evaporite series.

Details of the drilling operations are as follows: Spudded in 5th January 1956; 13⅜-inch surface casing cemented at 178 meters (584 feet); 9⅝-inch intermediate casing string cemented at 2,260 meters (7,415 feet) on top of the evaporite series; total depth of 8½-inch dia. hold 2,677 meters (8,782 feet). It intended to set a string of 7-inch extreme line casing on top of the main limestone. However this was not to be and the well blew in suddenly with an estimated production of between 80 and 100 thousand barrels of 32° to 33° gravity crude oil per day.

The blow out equipment was partially closed, but was unsuccessful in controlling the well. Fortunately the well did not catch fire, but it blew a large column of oil and gas about 150 to 170 feet into the air, and saturated the surrounding countryside. It

1. *Close-up of Alborz No. 5 before work of taming the wild well was begun. All photographs on this and the following page are reproduced through the courtesy of G. Heseldin, consultant to The Iranian Petroleum Co.*



2. *Derrick and substructure have been removed permitting well to flow freely.*

3. *Myron Kinley, B. Mostofi and F. Naficy standing on one of the fire barriers in the oil flow.*

was also fortunate that the gas was sweet. Hydrogen sulfide, the curse of a good many Middle East oilfields, appeared to be absent.

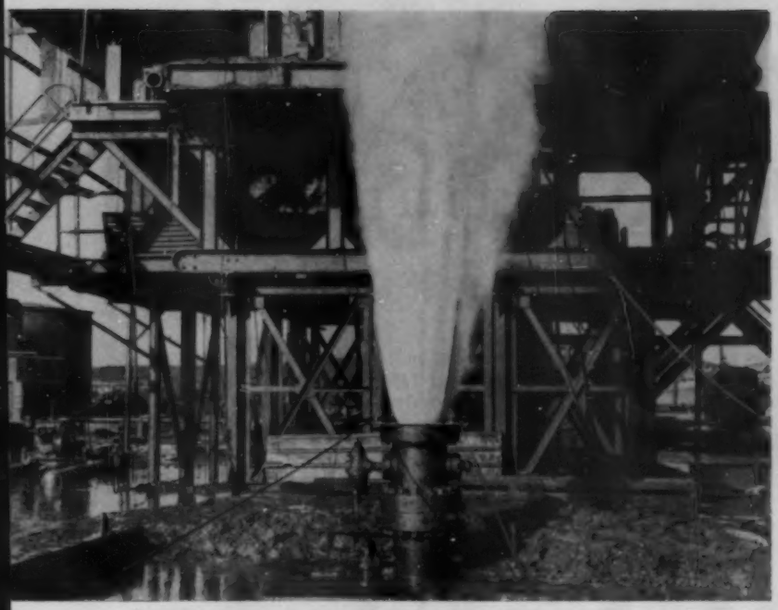
Prompt measures were taken to cordon off the area to prevent the well being accidentally set on fire. This job was most efficiently done by a detachment of troops from the 1st Division, Iranian Army. A telegram was sent immediately alerting Myron M. Kinley, the American who specializes in controlling wild wells. This was closely followed by another telegram requesting his presence.

To collect and control the large flow of oil, earthen dams were thrown across the natural drainage channels, and later, large earthen reservoirs were constructed. Assistance and help was offered and accepted from the Iranian Exploration and Production Co. (Consortium), the National Iranian Oil Co., the American contractors Messrs. Morrison Knudsen, the Public Works Department and the French pipe line contractors "Entrepose" who were working in the vicinity.

Mr. Kinley and his assistant arrived on August 30, and after inspecting the well left for Masjid-i-Sulaiman to collect material and have various pieces of equipment fabricated in the Consortium workshops. Mr. Kinley first began to clear all obstacles away from the well head. As much equipment as possible was removed by hand and then the drillpipe was cut in two by means of sawing it with a sand line passing back and forth on two power reels set back at a convenient distance from the work. Various bolts were removed and the derrick, which by this time showed signs of disintegration was pulled down and moved out of the way. After disconnecting more bolts and the rotary drive chain, the sub-structure was pulled out of the way and the well head removed at the flange on top of the 7-inch casing head.

The stream of oil and gas was now blowing clear of all obstructions with a short piece of drill pipe sticking up above the flange. This piece of pipe was sawn off by the sand line method, a special device having been made to get the sand line over the drill pipe in the large stream of oil and gas rushing from the well.

The Cameron "DV" valve and the stool previously used on the A.I.O.C. well "Rig 20" at White Oil Springs had been brought up from M-i-S and a similar hinge bolt and clamp made in the M-i-S workshops. Unfavorable winds delayed the operation at this stage but finally a 1½-yd excavator modified as a crane, was moved forward and the spool and valve placed in position and bolted up. The spool had two four-inch branches and one of these was left open when the Cameron valve was connected up to a Halliburton cementing truck and pressure applied to close the valve. The valve was closed at 6 p.m. on September 13 and the vertical stream of oil and gas which had been drenching the countryside for 18 days was now replaced by a horizontal jet,



4. *Flow from casing after derrick and substructure had been removed, and original well-head equipment sawn away.*

5. *Spools and Cameron valve to replace original well-head equipment being moved toward Alborz No. 5 on drag line.*

with a pressure of some 1,800 psi on the well head.

Efforts to close the well in by stages were not successful as the pressure built up to over 4,000 psi with the well still not completely shut in. Burning lines were prepared and the well burnt off for a period, but after two experiences of flow beans becoming blocked and raising the pressure unduly, the well pressure was reduced to some 1,800 psi through a 3-inch choke, waiting the arrival of additional high pressure well head and flow line equipment.

Myron Kinley states that it is by far the largest well he has had to tackle in his 35 years in the business. When the well was flowing at a pressure of some 3,200 psi it was estimated from looking at the flare, that it was making 10,000 to 15,000 barrels of oil per day.

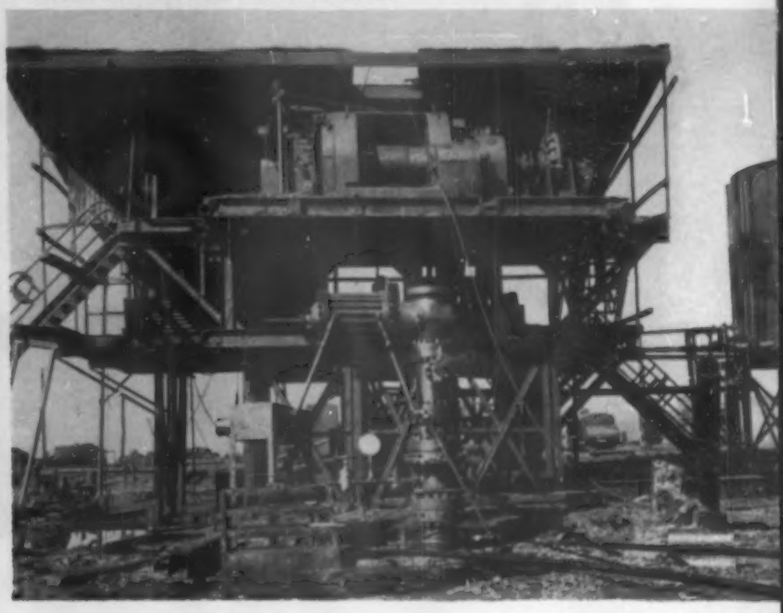
One interesting feature is the high temperature of the oil. A thermometer placed between the 12-inch flanges of the well head registered 220°F. and an oil sample collected from the river of oil running from the well had a temperature of 115°F. The oil is free from water but has a high pour point. The weathered crude oil is already being used as fuel oil in the Teheran power house. A temporary gas oil separator is being installed.

Special equipment is being obtained and it is hoped to be able to complete the well in a satisfactory manner.

The Alborz oilfield is the first new field to be found in Iran for many years. Due to its position near to the largest consuming areas of Iran it will be of great economic importance to the country. END.

6. *Well was permitted to flow through one of the new 4-inch side outlets after new well-head equipment was installed.*

7. *Well-head after closing side outlets. Well pressure rose to 4,000 psi making partial reopening of burn off lines necessary.*



IRANIAN OPERATIONS EXPAND
in second consortium year

In the two years which now has elapsed since the international group of oil companies known as the Consortium began operations in Iran the oil industry in that country has been restored to approximately the point reached at the time of nationalization. Production of crude and refinery operations have been maintained at a level well above that contemplated when the operating agreement of Oct. 29, 1954 was signed. Crude production and exports of crude and products have tripled. Output now is 10 times domestic consumption and may be 20 times internal demand in another two years.

Direct revenue to Iran from oil exports rose to £35 million ($98 million) in the fiscal year ended March 31. In addition, £18 million ($50 million) in foreign exchange was brought into Iran to meet operating costs. The oil industry thus poured £53 million into the Iranian economy, more than the total exchange earned by all other exports from the country. After another two years it is estimated that exchange earnings from oil will reach £85 million ($238 million) per year.

Iranian employment in the oil industry in the area operated by the Consortium companies now totals 50,000 nationals. Only 321 expatriates have been sent to Iran by the international companies to provide necessary technical and administrative skills necessary for operations. Of these 152 are British, 140 American, 26 Dutch and three French. Most of these are on two-year loan from participating companies. The loan scheme provides flexibility so that foreign technicians can be recalled to their former jobs as Iranians complete their technical training and become competent to take over specialized jobs. Various contractors have been using about 100 foreigners.

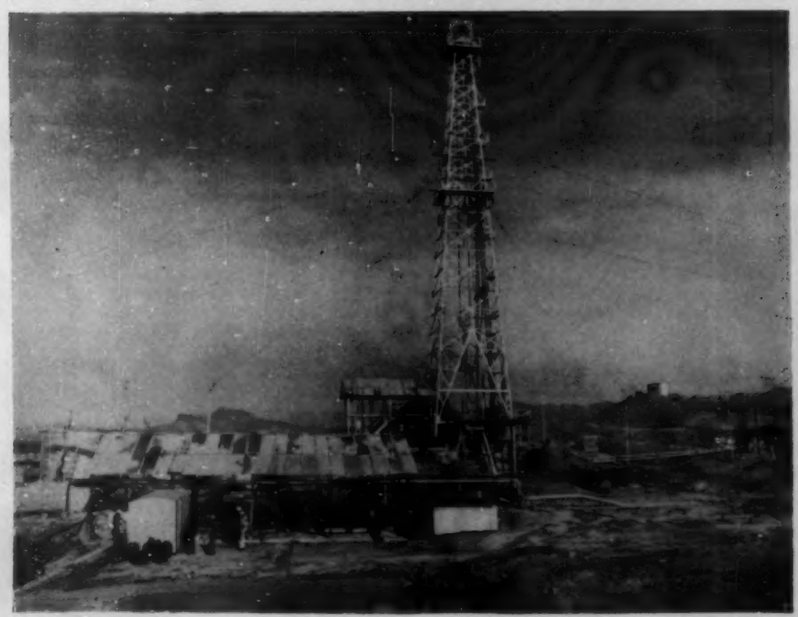
Operating companies began training of staff personnel within a few months after taking over. In the fiscal year ended last March, 50 Iranians were sent overseas. Training areas have included oil fields in Venezuela and the United States and refineries and other industrial installations in the United States, Britain, Holland and France.

Locally in Iran the Technical Institute in Abadan had 57 students in certificate courses and 117 in BSc courses. Teheran University students were given practical experience in fields and refineries. The technical training has been supplemented by general educational opportunities embraced by more than 6,000.

Gradual recommissioning of field, pipe line and refinery installations was the first order of business during the past fiscal year. This work now has been supplemented by new construction and development activities.

On July 26 last the Iranian Oil Exploration and Producing Company (field operating company set up by the Consortium) began drilling a deep wildcat test about nine miles west of the city of Ahwaz. This test known as Ahwaz No. 5 was begun on the Qarait structure in 1949 and taken down to 8,200 feet. Three earlier test wells in the area were abandoned because of technical difficulties in 1948-49. Special cementing equipment was brought in before drilling was resumed in Ahwaz No. 5.

Well No. 36 drilling at Agha Jari (All photos used in this article courtesy of Iranian Oil Participants.)



A tanker loads crude oil at jetty No. 3 a Bandar Mashur. Jetties 1 and 2 are in the background.

Alkylation plant at the Abadan refinery.

It is estimated that the Asmari horizon may be penetrated at about 10,000 feet. The well may be drilled to a greater depth to provide more data on deep rock structures of Khuzistan. Thus far there has been no commercial production in western Khuzistan so the test of the Asmari in this area is awaited with much interest.

A geological party has undertaken surface survey work in the coastal regions of the provinces of Laristan and Kerman to search for promising structures for testing.

Most of the older fields in Iran were well developed before the Consortium resumed operations. The newer Agha Jari and Naft Safid fields require additional drilling and the building of production units, roads and pipelines. Work is most active at this time in the Agha Jari field which is the largest producer among southern fields. The field has not yet been defined to the northwest and a stepout well in that direction is planned for early drilling. Recently development well No. 36 was completed as a producer at 6,300 feet and No. 38 was started by Santa Fe Drilling Co. as contractor. A fourth gas separation plant is being built in the field. The third was completed last year.

The foreign crew is aided by Iranian drillers and a special drilling school has been set up at Masjid-i-Sulaiman for retraining nationals who have had field experience in earlier years.

Work-over operations are active in Haptkel where pressures have been declining. It was found necessary to build a new production unit on lower ground to compensate for the lower well pressures.

In the Masjid-i-Sulaiman field a new 8,000 kw power plant has been commissioned. Each of the generators is driven by a gas turbine. MIS gas is too high in sulfur to be used as fuel so a 22-mile supply line was laid to Naft Safid.

The MIS topping plant is processing 20,000 b/d of crude to provide local fuel oil requirements.

As a conservation measure gas is replacing oil as fuel at Abadan. A crude line from Agha Jari was converted to gas service for this purpose. The Consortium has laid 50 miles of new lines in the fields themselves to serve the 2,000 miles of main lines connecting various fields with the Abadan refinery and crude loading facilities at Bandar Mashur. Overhauling the system included replacement of 11 miles of 16-inch line washed out by floods between Agha Jari and Moshur.

Offshore shipments of products from Iran move from Abadan through the Shatt-al-Arab which presents some navigational limitations to modern tankers. For this reason crude exports are being furnished through Bandar Mashur which is on a deep stream which can accommodate most super tankers. Vessels of 38,000 dwt are handled successfully.

There were two loading jetties in place when the consortium took over. Two more have been completed since that time and a fifth is now being planned. No. 4 was commissioned last March.

Foreign companies were granted a three-month period in which to begin export operations after the Iranian agreement was signed. By making preliminary studies, however, the Consortium found it possible to make an initial shipment on the day after His Imperial Majesty The Shah put his seal on the agreement on October 29, 1954. In the month of November, 17 tanker loads of crude were shipped from Mashur and 18 loads of products from Abadan. In the three-month period given the operating companies to start shipping, 49 crude tankers were loaded out and 80 tankers were filled with products. At present, 50 tankers per month are being loaded at Mashur and the total has reached 70.

To service the larger number of tankers more storage has been built and additional pumping facilities installed. There now are 20 tanks in place with a capacity of 2.5 million barrels. The four new pumps recently added provide a pumping rate of more than 100,000 barrels per hour. The expansion required installation of new pipelines, power and other facilities.

Much of the crude exported through the Mashur terminal is produced from the Agha Jari field, 48 miles inland. Oil flows partly by gravity to the terminal.

There are now 2,500 families living at Bandar Mashur. In the past fiscal year 425 new homes were built. This year an additional 525 will be completed plus additional recreational facilities.

The problem of the Consortium companies was made acute by the necessity to use the Abadan refinery as much as possible although the industry had changed its refinery pattern materially during the Persian shut-down. As one result of the shut-down, oil companies built new refineries in consuming areas rather than adjacent to crude supply sources. In the areas east of Suez which Abadan had largely supplied in

Pipe lines in the Agha Jari area.

earlier years, new plants had been built in Aden, India, South Africa, Japan, Australia, the Philippines and elsewhere. The Consortium companies did agree, however, to do their best to refine nearly half of the oil produced for export plus, of course, refined products to be consumed in the domestic market. In the past fiscal year Abadan processed 40% of the gross volume of crude processed in the field.

Under the agreement the National Iranian Oil Co. is permitted to take crude in kind instead of in money and it may have this oil processed at Abadan for export sales when buyers can be found, as well as to supply domestic markets. In the past year NIOC has taken 915,000 cubic meters of crude and 1,500,000 cubic meters of refined products.

In the first three years of the Consortium agreement a guaranteed outlet is given to Iran. After that period has elapsed the crude and products must be produced cheaply enough to compete for orders in world markets. Labor costs in Iran have been rising so the effort of the refinery operating company (Iranian Oil Refining Co.) is to get Abadan in shape for economical operation.

Much of the plant was shut down for three years and despite careful maintenance by the Iranian staff it has been necessary to employ a rehabilitation force of 4,500 craftsmen and helpers and 459 engineers. Of the engineers 400 are Iranian and 59 foreigners. The department engaged in rehabilitation also handles housing, transportation, power production and other functions. It has a total labor force of about 16,000 headed by an Iranian manager.

At the end of the fiscal year last March 114 major and 20 routine overhauls had been completed. By the end of this year the program calls for completion of 63 more major and 28 routine overhauls. By December 31, it is planned to have 80% of the plant including all major distillation units ready for operation.

At the end of the fiscal year three large distillation units were processing, 210,000 b/d of crude for major products, two vacuum units were producing lube stocks and an asphalt plant was supplying Iranian road material requirements. The 30,000 b/d catalytic cracker was in use as were the isomerization and two alkylation units for

IRANIAN PRODUCTION

(All oil figures in thousands of barrels)

Date	Gross Production	Crude Taken By NIOC	Crude Processed in the Refinery	Products Taken By NIOC	Number of Tankers Loaded at Mashur (Crude)	Number of Tankers Loaded at Abadan (Products)
November 1954	5,599	256	3,050	912	17	18
December	5,346	—	3,648	817	12	26
January 1955	7,170	667	4,591	974	20	36
February	7,548	1,013	4,560	912	26	28
March	9,372	1,258	5,126	1,069	36	31
April	9,057	453	4,560	1,010	33	36
May	9,120	106	4,780	975	35	36
June	11,007	528	4,686	912	49	24
July	10,944	491	4,591	943	48	27
August	10,976	465	4,812	880	50	31
September	11,321	818	4,466	817	49	52
October	10,850	503	4,403	629	45	35
November	11,479	365	4,246	597	45	33
December	10,755	478	4,403	629	43	43
January 1956	11,447	830	4,340	629	46	33
February	12,579	597	6,164	692	45	37
March	16,825	126	6,510	723	70	55
April	17,391	308	6,894	604	65	42
May	17,467	132	7,107	736	72	46
June	17,190	333	6,812	666	69	46
July	18,592	433	7,478	648	74	46
Total	242,030	10,082	107,165	16,768	949	741

Preparing to work over an Agha Jari well.

avgas production. There are two more isomerization units to be overhauled. When the cat cracker went on stream it required 24,000 man days and the No. 3 alkylation required 21,000 man days. A large distillation needed 9,000 men days for an overhaul.

Policy of the Consortium companies is to transfer the operation of supporting services to the National Iranian Oil Co. as rapidly as possible. Plan is to have nationals provide all medical and educational services, build housing developments and operate retail and service establishments. Medical and health services already have been handed over by the oil companies. These include three large hospitals with 1,000 beds, staffed by 2,000. These have been enlarged during the past year and four clinics have been built.

The operating companies have set aside £500,000 ($1.4 million) as a contribution to school construction work in the oil areas, and much attention has been given to housing construction. At Abadan 800 houses and in the field 900 are scheduled for the first two years.

Iranian income under the agreement consists of a royalty of 12.5% plus tax payments to make up a 50-50 division of revenue in excess of operating costs. During the past fiscal year royalty payments were as follows:

In cash	£ 6,417,015
In oil	£ 3,878,018
	£10,295,033

Income tax payments were as follows:

Operating companies	£ 687,740
Trading companies	£24,830,250
	£25,517,990

In addition the companies made payments more than £22 million in Iran for labor, taxes and purchases. Total foreign income brought in by oil was about £53 million.

The Consortium companies now include British Petroleum Co. with a 40% interest; Royal Dutch Shell Group 14%; Standard Oil Co. (N. J.), Gulf Oil Corp., Standard of California, The Texas Co. and Socony Mobil Oil Co. each 7%; Compagnie Francaise des Petroles 6%. The remaining 5% is divided among the following nine U. S. companies: American Independent Oil Co., Atlantic Refining Co., Hancock Oil Co., Getty Oil Co., Richfield Oil Corp., San Jacinto Petroleum Corp., Signal Oil & Gas Co., Standard of Ohio and Tidewater Oil Co.

The Consortium set up a holding company with London headquarters known as Iranian Oil Participants, Ltd. and two operating companies as previously mentioned.

Partners in the enterprise in Iran include the Iranian government and the National Iranian Oil Co. the government company which owns the oil reservoirs and the fixed plant. N.I.O.C. handles domestic oil distribution in Iran and has been wildcatting in the north. As a result of this activity it has discovered what appears to be another major oil field at Qum.

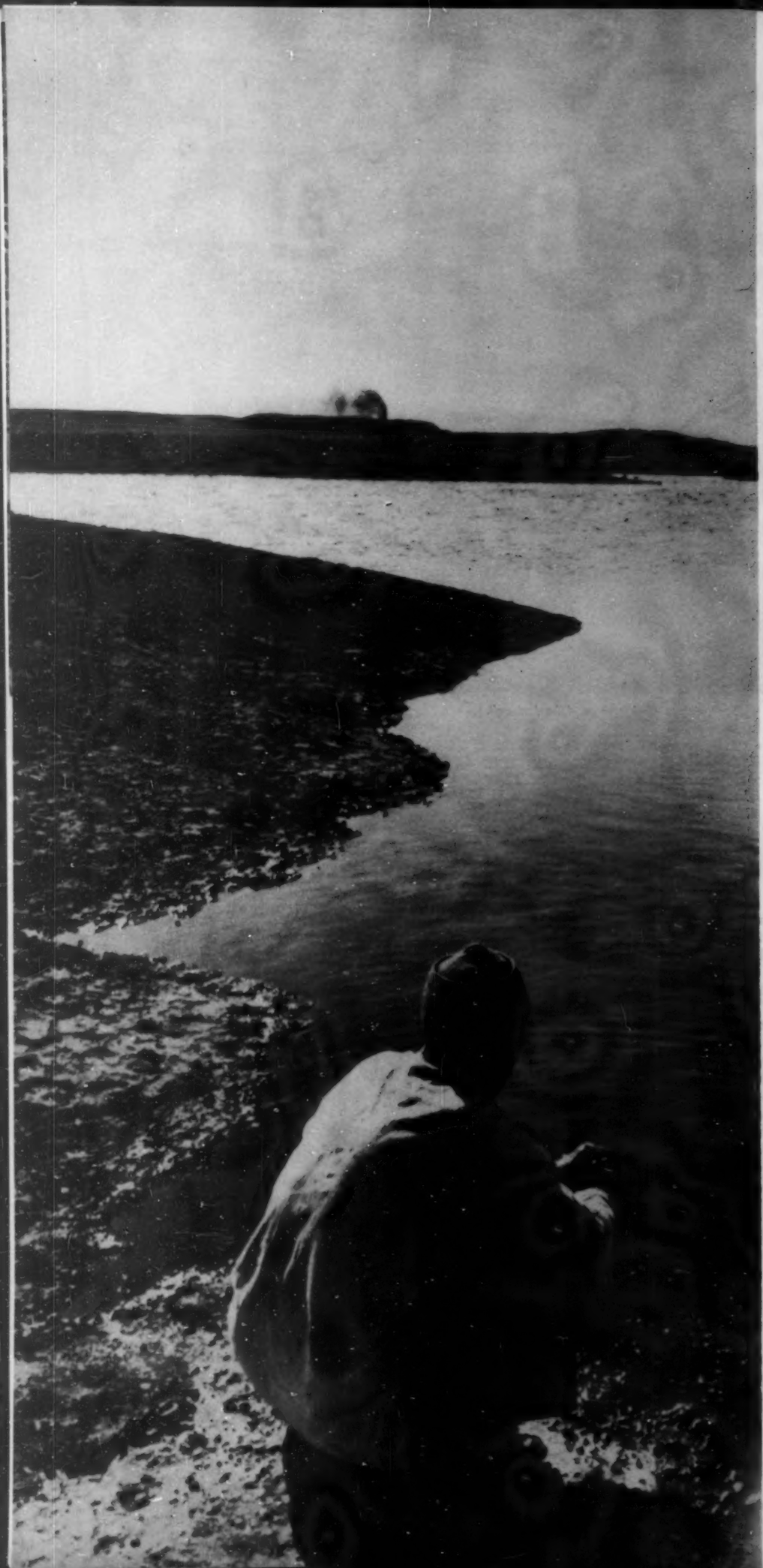
The Consortium established two companies with headquarters in Iran to operate all the oil installations in the areas covered by the agreement.

These companies were incorporated in the Hague under the laws of Holland, with head offices in Teheran.

They are Iraanse Aardolie Exploratie en Productie Maatschappij (Iranian Oil Exploration & Producing Co.) N.V. which deals only with field problems and crude oil production, and Iraanse Aardolie Raffinage Maatschappij (Iranian Oil Refining Co.) N.V. which deals with crude oil refining into its various products.

The Consortium also formed a company in London, Iranian Oil Participants, Ltd., to hold the shares of the two Operating Companies which were allotted in proportion to the interests of each of the Member Companies. Another company Iranian Oil Services Ltd. has been formed in London which provides the operating Companies with services outside Iran such as purchasing, overseas recruitment and technical advice.

The two Operating Companies in effect operate on behalf of the National Iranian Oil Co. to the extent stipulated in the agreement. In addition there are the Trading Companies who deal with the distribution of the crude oil and refined products. There are seventeen of these companies, one for each member of the consortium and their duty is to find markets for Iranian Oil, through their parent and associated companies. END



NORTHERN

By Theodore Wild*

IN an earlier article in the August 1955 issue of WORLD PETROLEUM relating, among other things, to the oil potentialities of one of the Tertiary Basins in the interior of Iran, namely the Qum Basin and its extrusive salt plug, it was recommended that deeper drilling be undertaken at various distances from the rim of the plug. Now that the National Iranian Oil Co. has had such a spectacular success in the program suggested by this author, it is fitting to focus attention on the potentialities of other areas outside the Consortium Concession.

The exploitation of the Persian Gulf Offshore areas, as outlined in the above mentioned article should better be left in the capable hands of the Consortium or other oil operators. In this discussion I intend to focus some attention on the Caspian Sea offshore and adjacent areas of northern Iran. This is an area in which the National Iranian Oil Co. is particularly suited to conduct operations as was originally contemplated. The flow of oil from the Caspian area will at long last compensate for some of the continuous subsurface piracy by the Russians.

Historical Background. Granting of concessions by Iran to foreign interests have always resulted in counter-claims to concessions by the Russians. During World War II in 1943 and 1944 several American interests, including the Sinclair Oil Corp. sent representatives to Teheran to negotiate petroleum concessions in Persian Baluchistan. Some of their representatives, such as Mr. Wilson of Sinclair visited me regarding their mission. I was then Director-General of the Department of Mines in Iran.

The Teheran Government at that time engaged Mr. Herbert Hoover, Jr. and Mr. Curtice as advisors and consultants to negotiate with the applicants. As the negotiations were approaching fruition, the Russians stepped in and applied for a concession in northern Iran. They made it clear that since the Teheran Government was seriously considering the American applications, they expected similar consideration in the north. It was thus that the Iranian

* *Reservoir Engineer & Geologist.*

◀ *Lake of oil from National Iranian Oil Company's Qum gusher.*

Outcrops and other evidence suggest that major oil accumulations are present offshore from Iran in the Caspian Sea and in the general onshore area recently spotlighted by the Qum wildcat discovery.

IRANIAN OIL POTENTIALS

Government became cognizant of the implication of the Russian requests, implications which were reminiscent of the imperialism of Imperial Russia, and therefore hastened to introduce and pass a bill in the National Assembly, forbidding the government to grant any petroleum concessions to foreign applicants but firmly bidding it to encourage local capital to cooperate with the central government in the promotion and exploitation of the petroleum resources of the country. This is how the National Iranian Oil Co. was created. Since its creation it has drilled several dry holes in the Qum salt plug area until finally it brought in its recent gusher.

Russian Fields Around the Caspian Sea. The Caspian Sea is literally surrounded by several prolific Russian oil fields, which include the renowned Baku field. Daghistan oil field to the northwest of Baku oil field has been active in offshore drilling for a considerable time. In the August 15, 1956 issue of *World Oil* Dr. J. Brian Eby remarks that the oil production of Azerbaijan Republic of which Baku is the principal producing area, has held steady at around 300,000 b/d since 1950. This steady production has been achieved by the development of Caspian Sea offshore area and reworking of wells in the old Baku field.

The Caucasus mountains chain like its extensions to the northwest and northern Iran, has a core of granitic, diabasic and altered Paleozoic rocks. This core rock is overlapped by a thick section of oil-bearing Tertiary formations which uncomformably overlie Mesozoic sediments. Tertiary oil accumulation in this area is primarily either a structural accumulaton, which involves angular overlaps of Tertiary over older rocks like Maykop field.

In the southeastern area of the Caspian Sea, in the vicinity of Krasnovodosk, the important oil developments occur in rather acute foldings in the Tertiaries. These foldings are the continuation of what occurs across the sea at Baku oil field. If this is the case, then the same foldings should be present below the bottom of the sea. This assumption, which is strongly supported by surface indications, make the Iranian offshore area at Bandar Shah and the adjacent plain of Grogan of great oil possibilities.

North of the Caspian Sea, the prolific Emba fields tap their oil from older zones, such as Jurassic, Upper & Lower Carboniferous and Devonian limestones. The prolific Molotov, Kuybyshev and other fields in the Volga drainage basin tap their oil from Carboniferous and Devonian limestones. These older sediments crop out on the northern slope of the Elburz chain of mountains of Iran, overlooking the southern shores of the Caspian Sea. Surely the southern Caspian Sea offshore area should have good potentialities for oil development in the deeper horizons.

Outcrops and Supporting Evidences in Northern Iran. Devonian:—Along the River Araxes, which separates Iranian Azerbaijan from Russian Azerbaijan, gray marly chalk of Middle Devonian age with Favosites goldfussi and Sperifer spesiosus crop out at the village Daleeha and elsewhere to the southeast in the direction of the Caspian Sea and the Elburz ranges. This is overlain by a reddish thick limestone bed containing Rhynchonella sp.

Carboniferous:—The gray slaty limestone of the Upper Devonian in northwestern Iran is overlain with 330 feet of limestone of Carboniferous age; they contain Sperifer striatus and they extend southeastward towards Teheran.

Permian & Permo-Triassic:—Subsequent to the Permo-Carb movements which uplifted considerable area of the Caucasus into dry land, the Permo-Trias sediments were deposited, probably in a gulf of a sea which stretched across to India. The Permian limestone, which contains Brachiopods, is overlain with Triassic quartzite and is underlain with Carboniferous dark dolomitic limestone.

Cretaceous:—In the Elburz ranges north of Teheran, in the Lar River area, dense gray limestone with Hoplites overlies Jurassic sediments.

Eocene & Oligocene:—In the Elburz ranges a sequence of bluish green tuffaceous sandstone and clay, considered to be Oligocene, overlies Nummulitic limestones.

Fig. 1—Map showing Caspian Sea Basin and its oil fields and the Iranian offshore area.

Reservoir thrown up to contain oil from Qum gusher. Photos courtesy Iranian Oil Participants.

Fig. 2—Map showing Iranian fields, concession area and the Qum discovery.

Hot Sulfur Springs:—Numerous hot sulfurous springs, some of which are of national and continental reputation as health resorts, extend all the way from Ardabil in southwest corner of the Caspian Sea to Bandar Shah in southeast corner of the Sea.

Disposal of the Oil. The question has been raised time and again as what to do with the oil of northern Iran once it is found. The recent huge gusher at Qum salt plug has opened up enormous possibilities for that area. If similar gushers and big fields are found in other areas such as those adjacent to and offshore the Caspian Sea, the surplus oil disposal problem will become acute since the domestic market will consume only a fraction of that enormous productive capacity.

My answer to the problem is briefly as follows. National Iranian Oil Co. is constructing (contracted to American, British and French pipe line companies) 573 miles of 10-inch pipe line from Ahwaz in the southern oil fields to Teheran, with the daily capacity of 40,000 barrels.

The Qum and the Caspian Sea Basin oil can best be used first for the domestic market. To do so a small refinery can be constructed north of Teheran on the bank of one of the rivers which flow into the Caspian Sea. Such a refinery unit together with the refinery facilities in Kermanshah (left over by the former Anglo-Iranian Oil Co.) will be sufficient for the domestic market.

For the remaining quantity of oil which will eventually be by far the larger percentage of the production, the above mentioned pipeline can be used then to take the oil southward rather than bringing the oil from the south as it is intended to do now when it is finished. Of course arrangements should be made with the Consortium, particularly with reference to the price, to make it possible and profitable for the Consortium to take over the oil and to export it to world markets. END.

RUSSIAN OIL EQUIPMENT—*Salesmen are on the road*

With more than a third of its industrial labor force engaged in machine tool production and metallurgical fields Russia is fast developing a line of oil equipment and a surplus producing capacity enabling the Soviets to sell in export markets.

By G. G. Rosu and J. C. Chatfield

SOVIET salesmen are busy these days calling on prospective buyers. The prospects are primarily buyers of industrial equipment and they include oil producers, pipe liners and refiners.

While Russian turbodrills have been most widely publicized, the list of items now available for export from the Soviet Union is extensive. The variety of products offered is indicated in the accompanying advertisement published in a Russian magazine distributed in English speaking countries. It will be observed that the advertisement mentions virtually every general type of equipment used by the industry.

Until recently Russian industrial equipment was exported mainly to satellite countries. China was a large buyer of producing equipment. Austrian and Hungarian as well as Romanian oil fields were supplied with Soviet drilling rigs and pumping equipment. With Russian industrial output growing, the areas in which business is sought has been expanding. In some cases the equipment is manufactured in satellite countries.

At a trade fair in India a year ago the Russians exhibited a drilling rig. After the fair was over the rig was dismantled but was not returned to Russia. Instead it was stored locally. This year the rig was sold to the Indian Government along with another for $1.5 million, plus accessories and spare parts for one year's operations. Twenty-two Russian technicians go with the deal at an additional cost of $220,500 to train Indians for six months. Similar equipment has been offered in Israel and other non-communist countries.

A similar situation exists in the refining field and in tubular goods which may be employed in any of the branches of the industry. European as well as Asian interests contemplating refinery construction work have been approached for business.

Where the Soviet does not enter into selling directly, the satellite countries may do so. Early this year the government of Syria authorized a new 20,000 b/d refinery. Bids were invited and received from several international concerns, including some from both Western and Eastern nations. Russia was invited but only submitted a general catalog of equipment which was not sufficient for bidding. Czechoslovakia was represented, however, through Technoexport, and reportedly underbid western offers. The Czechs offered a ready-to-assemble plant that would cut assembly time, and a total price of 20% under the nearest competitor. The Czechs seem likely to receive the contract, at latest report.

Within the past few years Russia has been working hard to increase its domestic production of oil. Immediately after the war it was necessary to import considerable volumes of petroleum. Austria, Hungary and Romania were the principal contributors. In 1950 5.5% of all Russian imports consisted of petroleum and its products. By 1955 this had fallen to 2.8%, consisting largely of reparation payments.

At the same time Russian oil exports were rising. Oil was being sold to Iceland and the Scandinavian countries, Italy and Israel as well as communist countries as far away as China. In 1950 only 1.5% of Russian exports consisted of oil whereas in 1955 the percentage had grown to 6.4%.

In the case of oil as well as equipment the USSR uses exports as an instrument of national policy. Prices of products and equipment may be highly favorable as was the case of the refinery offered to Syria and drilling rigs sold to India or may be paid for in barter goods perhaps not absolutely necessary to the Russian economy. Yugoslavia has been buying most of its crude petroleum from Russia recently. Imports of Soviet crude have been averaging 4,000 b/d and in turn, Yugoslavia has been selling prunes and leather goods to Russia. Israel has been paying in citrus fruits. In both cases it may be remarked that Russia has not been noted for its encouragement of imports of consumer goods.

Important customers of Sojuzneft export are able to obtain choice grades of crude. The best of all is said to be "Sokolovogorska" formerly known as "Nobel II." This oil is about 36° API gravity and has a sulfur content of only 0.5% whereas many Russian crudes are quite sour. On distillation the crude yields of 30% overhead at 200°C and 50.5% at 300°C.

Between World Wars I and II Russia at times disrupted oil markets in Europe by offering products at prices below general market levels. Since the Soviet oil trade has been expanding in the past three or four years similar disruptions have not been noted possibly because of the small volume of oil still being sold. As noted previously, however, barter trades have been favorable in the case of some customers. Since exports of oil as well as machinery are sold by the Government, price cutting may be expected if it will serve a national purpose.

Although some of the equipment sold by Technoexport actually is manufactured in satellite nation factories, it usually carries Russian name plates and sales are made by Russians. This is possible under the terms of Soviet trade treaties with its affiliates. It is reported that Russia made long-term flat-price contracts some years ago which now are highly favorable to the Soviets because of the inflationary spiral which has continued since the war.

Russia has indeed come a long way from the post-war period when she did not have enough equipment to patch up her badly damaged oil industry, and when her most-up-to-date refining installations were those sent by the United States under the lend-lease program.

To fill in the gaps left by the war, the Red Army supplied in occupied Europe the famous concept of "war booty" which, in Soviet, interpretation, covered also drilling equipment, pipe stocks and entire refining installations. No official protest could stop Russia from robbing Western oil companies working in Eastern Europe of all their reserves of equipment and materials.

The subsequent Western embargo on shipments of strategic goods to the Soviet Orbit cut off Russia's last possible supply source of equipment. The Soviet reaction was a policy of self-sufficiency. During the last eight years Russia has developed an oil equipment industry which is now capable of producing the most complex drilling tools and refining installations.

The increase in crude production bears proof of the efficiency of the Soviet petroleum equipment industry. Crude output

rose from 610,000 b/d in 1948 to 1,400,000 b/d last year. Drilling activity increased almost four times during the same interval. Up to 1948, Russia completed a small number of wells annually, at limited depth, because of inadequate supplies of drilling equipment and materials; last year, however, she was able to drill a well 18,000 feet deep. Prior to 1948, she relied upon natural pressure and pumping in well operation; last year, almost 40% of the total crude was surfaced by secondary recovery methods.

A large growth in crude production was recorded also in the oil-producing countries of the Soviet Orbit, such as Romania, Hungary, China, Poland, Czechoslovakia, Albania and Bulgaria. Their cumulative production jumped from less than 100,000 b/d in 1948 to 280,000 b/d last year.

Recent visitors to Russian oil fields have reported that the equipment they saw is rugged in construction, and not smartly finished. There is no chromium plating to dazzle the buyer. They observed, however, that the equipment does the job. In refineries and chemical plants, instrumentation and automatic controls appear to be widely used. Drilling and producing equipment is said to follow designs similar to those used several years ago by oil operators in Western nations. How rapidly these designs will be improved in the near future will be governed by the Technoexport's ambition to step up its selling campaign and, implicitly, by the competition with Western equipment manufacturers.

In the processing sector, while the topping capacity of the Soviet Orbit kept pace with the crude production, its cracking capacity doubled during the same period. Plans for 1960 provide for doubling the crude production as compared with 1955, and for a commensurate increase in the refining capacity.

It is true that, in its present stage, the Russian and East European refining industry is still wasteful by Western standards. Existing installations seldom form an integrated unit processing a complete line of products similar to those built in the West during the last decade. However, the refineries now in construction at Omsk, Novosibirsk and Ufa, when finished, will compare favorably with the best refineries in Western Europe.

Because of its state-managed economy the USSR has been able to channel its productive capacity into industrial goods since World War II. Recently, 21% of the national income has been devoted to heavy industry. The annual rate of increase in capital goods since World War II has been at the rate of 6.7% per year compounded. If this rate could be maintained it has been estimated that Russian industrial output would surpass the United States by 1970.

Out of the 200 million population in Soviet Russia the industrial working force last year totaled 48,358,000 persons. It is significant that of this number 31.5% were engaged in machine building and metal working. In addition, 5.7% were in metallurgical industries, including ore extraction and 7.5% in fuel industries. This means that 5,469,000 persons were engaged directly in metal working and machine building backed by 990,000 in ore extraction and metallurgy, 1,300,000 supplying fuels and 907,000 in producing construction material outside of the logging and wood processing industry.

Energy output in the USSR has developed at a very rapid rate in the postwar period. Unlike many European countries Russia has increased its coal output in line with oil and electric power. In 1945 coal output was 99.4 million tons and last year the total was 276.1 million tons. Electric power had risen from 43.3 to 170.1 billion kwh. The hydroelectric power content rose from 4.8 to 23.1 billion kwh in the same period. Oil production rose from 388,000 to 1,416,000 b/d in the postwar decade.

Emphasis now is being placed on natural gas as an energy source to supplement coal, oil and electricity. Prior to World War II in 1937, Russia produced 81,836 million cubic feet of gas. By 1950 output had risen to 218,277 mmcf and last year was 365,738 mmcf. Plans are afoot to enlarge the gas pipe line system so that more industrial plants can be supplied.

Ferrous metals for machine builders have become more plentiful through the years along with the energy required for mining, transportation, refining and fabricating. Following is the output of pig iron and steel by years since 1945.

	Pig Iron	*Steel*
	Millions of Tons	
1945	8.8	12.3
1946	9.9	13.3
1947	11.2	14.5
1948	13.7	18.6
1949	16.4	23.3
1950	19.2	27.3
1951	21.9	31.4
1952	25.1	34.5
1953	27.4	38.1
1954	30.0	41.4
1955	33.3	45.3

Government plans are for continued expansion in the heavy industries during the present 5-year plan ending in 1960. By that time, pig iron output is scheduled to reach 53 million tons, steel production 68 million tons, coal output 593 million tons, oil 2, 700,000 b/d and electric power 320 billion kwh.

Through improvements in mechanization and automation Russia has been able to improve worker productivity. Output per worker in 1955 was 44% greater than in 1950. Production volume was increased 98% in the five years while the industrial personnel increased only about 22% from 14.1 to 17.4 million.

Engineering and technical personnel has increased more rapidly than the working force in industry. In the past five years the technical and engineering staff in industry has grown by 29% to 1.5 million representing 9% of the total compared with 8.5% five years ago.

Including correspondence course students there were 1,867,000 persons enrolled in 765 higher educational institutions. Supplementing these the Soviets maintain 3,757 secondary special educational institutions teaching 1,961,000 students of which 1,674,000 are in full time atendance.

A great deal of research work is being done in Russia. At the end of 1955 there were 96,500 scientific workers in special research institutions. Another 119,100 scientists were engaged in teaching.

Considerable significance may be attached to the volume of machine tools now being manufactured in Russia. In 1955 output of metal cutting machine tools was 117, 800 units compared with 70,600 units in 1950. There were in use in Russia at the end of 1955, 1,760,000 machine tools, an increase of 140% over 10 years ago.

Output of large, heavy and unique machine tools totaled 3,541 in 1955 compared with 1,537 in 1950 and 212 in 1940.

Powered press and forging machines built in 1955 totaled 15,900, bringing the total in service to 365,000. This was an increase of 207% over 1940.

New types of machines are being developed rapidly as the Russians are attempting to broaden their line of industrial equipment. In 1955, for example, there were 1,056 new types of metal cutting machines developed to the commercial stage. New type presses and forges totaled 193, foundry machines 11, chemical pumps and compressors 82, and construction and earth moving machinery 118.

Construction of specialized plants for manufacturing oil equipment started in 1950. The program had to be delayed until the engineering industry was capable of manufacturing machines for tooling oil equipment plants as well as by the scarcity of electric power. During the 1951-1955 period, output of petroleum equipment grew three-and-one-half times over 1950. In 1955, a new department—the Ministry for Oil Industry Constructions—was created for running this specialized industry.

The biggest center is the Uralmash (Ural Heavy Machine Works) at Sverdlovsk which produces the bulk of Russia's drilling equipment. Also at Sverdlovsk there is another metallurgical plant for further processing of drilling outfits and spare parts. Leningrad is the second oil equipment center, followed by Baku City with two plants. Manufacturing of turbodrills is concentrated at Kungur in the Urals, and at Gorki. The production of tubular goods is concentrated at Sverdlovsk, Baku and the Kirov Machine-Building Plant at Tbilisi, the heavy tube-rolling mills of which could favorably compare with Western similar mills. Additional capacity is available at Novokramatorsk plant at Stalino (Ukraine) where also special machines for forging drilling tool joints are manufactured.

Production of refining installations is concentrated at the Ural Chemical Machine-Building Plant at Sverdlovsk but Magnitogorsk and other plants located in the European part of Russia also are contributing equipment.

The current Five-year Plan provides for

a total industrial investment of 990 billion rubles. This exceeds the total funds invested during the decade from 1946 to 1955. Out of this amount, some 450 billion rubles are for construction of new plants for heavy industry. At the official rate of exchange of four rubles for $1, this represents an average of $22 billion per annum (the current investments made by private US investors into all kinds of plants runs at the annual rate of $38 billions). The investment funds earmarked for all the other Soviet industrial branches, including transportation, communication, consumer goods and services, will average 30 billion rubles per year (or $7.5 billion, at the official rate of exchange).

The retooling of plants will make great strides as the production of automatic metal cutting machine tools increases. Last year, a third of the existing 1,760,000 machine tools were automatic ones. By 1960, the machine-building industry is expected to have five times as many automatic and semi-automatic production lines as in 1955.

The Plan further provides for the completion, by 1960, of 100 new engineering plants in the Eastern areas, i.e. the Urals, Central Asia and Siberia, the majority of which will be equipped with automatic lines of production. These plants will afterwards manufacture the complex machinery required for building the Soviet chemical and petrochemical industries. The present degree of efficiency of the Soviet refining industry will thus be greatly improved.

Another characteristic of the Soviet planned society is the rapid increase as previously mentioned of engineering and technical personnel—the so-called "cadres"—at a quicker pace than its working force. Russia now turns out more specialists per year, and will soon have a numerical superiority over the USA. The over-all quality of Soviet scientists is said to be excellent.

The enrollment of technical day-students is higher than in the USA and, in addition, there are thousands of correspondence course and evening course students who will soon boost the "cadres." At present, there are more technically trained graduates per unit of industrial output than in the USA. This tends to make up for the lower investment per worker and helps to raise labor productivity.

Owing to its compulsory system, it is no great problem for Russia to train tens of thousands of workers per year in new production methods, particularly when the expected results for the State will be a substantial saving in investment funds, wages and materials. Hundreds of engineers, technicians and foremen are assigned, at short notice, to training programs, the attendance of which is compulsory. Most of the training is done on the worker's free time.

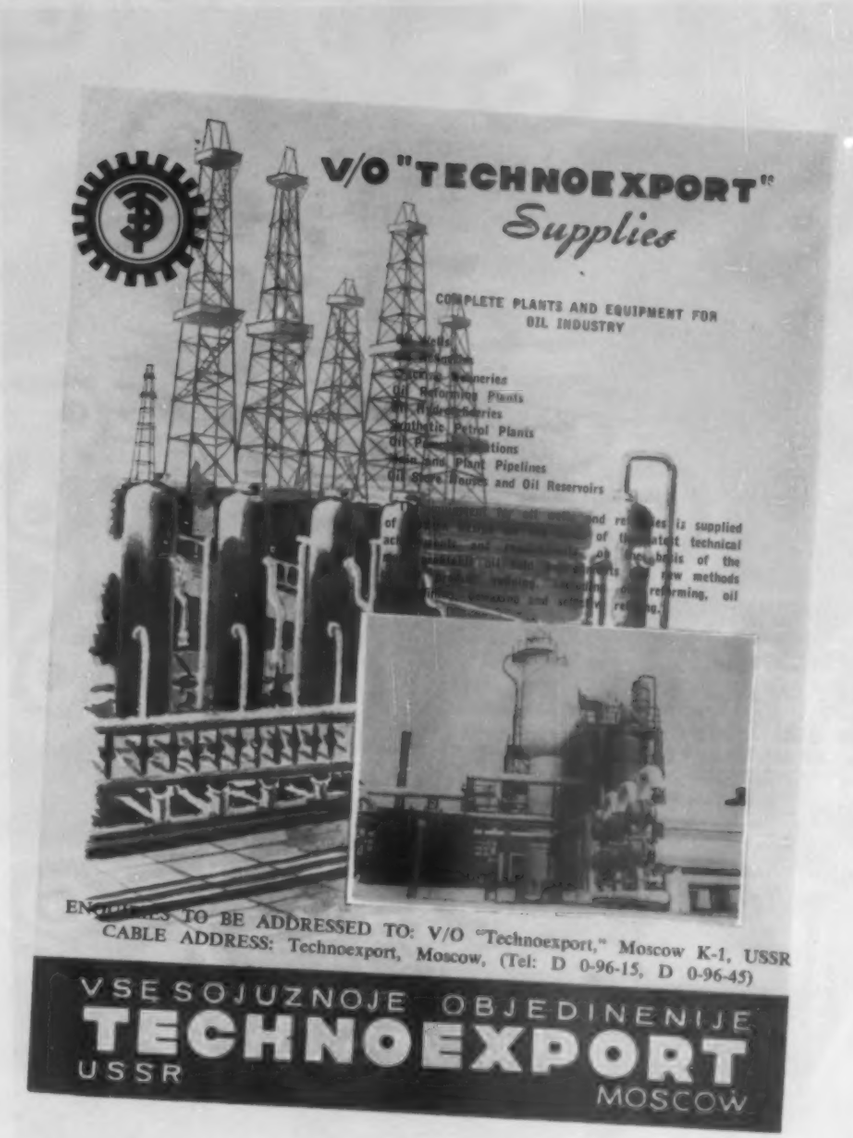
The Soviet oil industry is second only to electric power stations in regard to the number of technical "cadres": the ratio may be now close to 20 engineering-technical personnel per 100 workers. Soviet institutes are pouring out graduates for the oil industry at a rapid rate. Students are trained for geology in 21 departments of the existing 33 universities; in additional 24 faculties the major fields of training are geology and mining exploration. Finally, in 26 other higher educational institutes students are being trained exclusively in geology, mining and petroleum engineering. The courses consist of 5,000 hours of formal education over a period of five years and, in addition, the students spend much time in laboratory research, scientific discussion groups, and in field applications.

All petroleum research is now centrally directed by the USSR and the Regional Academies of Sciences which solve practical problems for production organizations through co-operation agreements. A commission to give scientific assistance to the petroleum industry was established in 1953. Later on, all research workers and technicians were gathered into a Petroleum Industry Scientific Research Society which mobilizes all competent forces for solving oil problems. Additional assistance is being received by this industry from the Central Institute of Scientific Research for Mechanization as well as from the Institute of Automatics and Telemechanics. It was these institutes that, in 1953, helped the Soviet oil industry to apply the automatic repressuring method, and to put under automatic control the wells of the Azerbaijan Oil Union.

The capacity of the Soviet Orbit for manufacturing oil equipment is not confined to Russia alone as was mentioned previously. Among the Soviet-controlled countries, Romania, Czechoslovakia and Eastern Germany are important suppliers of such goods. Prior to 1940, their manufacturing plants were capable of producing a long list of oil equipment. After the war productivity was slow in getting started again.

In 1952, Russia established in Romania a joint corporation for manufacturing oil equipment. Since then, large expenditures have been made for retooling and enlarging existing plants. Today, Romania manufac-

(Continued on page 164)



Advertisements similar to the above are appearing for the Russian "Technoexport" firm in English-language publications.

THE SUPER

By Jack W. Hale and
Herbert O'Connel*

SUBMARINE sea-loading lines are being considered by many observers as the most feasible answer to one of the major oil transport problems of the world today.

With the increasing number of super tankers coming into operation over the world's waterways, oil companies and shipping executives in every corner of the earth are being faced with the problem of finding an efficient and economical means of loading and unloading these giant vessels.

For many years, harbor facilities throughout the world have been adequate for handling vessels with maximum drafts of 35 feet. These same harbors, however, are inadequate for handling new super tankers, most of which require a depth of 50-60 feet for safe navigation.

The 15 super tankers of 40,000 dead weight ton capacity and larger in service over the world today are seldom able to come into port to discharge their cargos. They are either operated at less than full capacity; their cargos are trans-shipped to smaller vessels for transporting to terminal facilities; or they are being loaded and unloaded through submarine pipe line sea-loading lines to storage facilities on shore.

Few sea-loading systems are being operated in the world at present, largely due to the seemingly insurmountable hazards that would accompany such an installation.

Contrary to general belief, these difficulties have been overcome to a great extent by the world's top submarine pipe line construction firms.

Experience and the development of specialized methods and equipment have transformed a complex, almost impossible task into a simple and methodical operation, which can be accomplished in a matter of days.

To enlarge a single harbor to the extent that it could accommodate a 100,000-ton tanker would involve an expenditure of $30-$40 million. Yet many port commissions or harbor authorities are currently discussing plans for a harbor improvement program.

The installation of a complete submarine sea-loading facility could be made

* Collins Construction Co., Port La Vaca, Texas.

S/S Spyros Niarchos, a 47,500 dwt tanker of the type which is creating port problems for shippers and which cannot traverse Suez fully loaded. Photo courtesy of Transoceanic Marine, Inc.

TANKER PROBLEM

Port facilities for loading and unloading super tankers of 50,000 dwt and above are unavailable in most areas. Operation of sub-sea terminals in the Eastern Mediterranean, at Bombay and elsewhere has shown that the big tankers can be loaded and unloaded quickly and safely in unprotected harbors under most weather conditions.

at one-tenth the cost of a single harbor enlargement program.

If harbors are enlarged to meet the requirements of a 100,000-ton tanker, it is not inconceivable that they would soon be outmoded by an even larger tanker—one of 200,000-ton capacity, or perhaps a 500,000 tonner.

It is true that a tanker of such proportions is purely imaginary. But how many engineers were working on plans for a 100,000-tonner five years ago?

With the development of oil reserves in all parts of the world, it is becoming necessary for the capacity of tankers to be increased in order to transport petroleum products over greater distances more economically.

Some 65 additional super tankers of 40,000-ton capacity and larger will be in service by 1960. Loading and unloading facilities must be completed by that time in order for these tankers to operate at full capacity.

The enlargement of one harbor could require as much as five years, including planning, dredging, widening, building of docks, and the purchase of costly real estate.

A complete sea-loading system can be installed in less than six months, or before plans for the enlargement of one harbor could be completed.

A sea-loading line can be installed to a depth at which the largest super tanker conceivable can maneuver under its own power. The same methods of installation are used in 15 feet of water, or in 200 feet of water with the same results.

A complete sea-loading facility includes a protected submarine pipe line beneath the bottom of the sea; complete mooring facilities at sea; submarine hoses at the end of the line; and a land line linking the submarine line to a storage installation.

This system, whether designed to serve an existent crude terminal without the depth required for accommodating super tankers, or whether it is designed to serve a new facility, can be adopted at a saving —both in time and money.

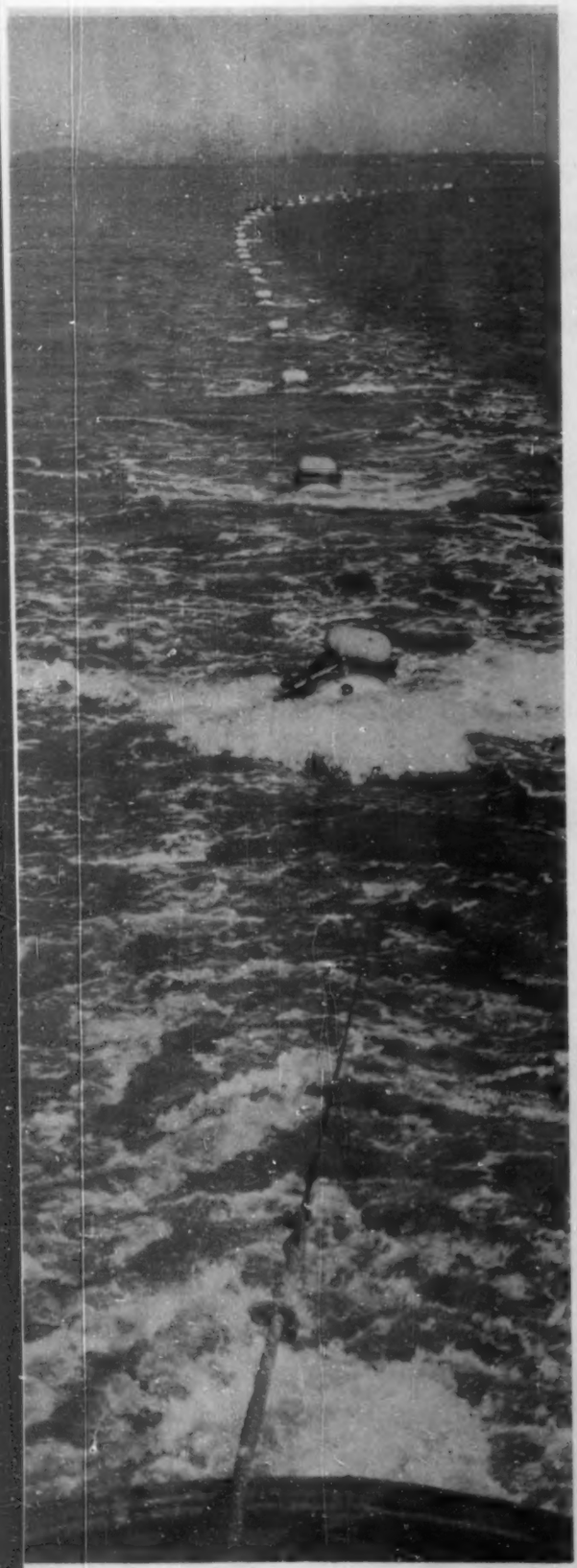
Almost all of the super tankers in service today have been launched since 1954. The largest of these is Daniel Ludwig's "Universe Leader," an 84,730-dwt super tanker recently completed in Japan's former naval yards at Kure.

Most of these vessels are forced to operate at less than full capacity in order to squeeze through the world's various ship channels and waterways. When fully loaded, they are routed through deeper waters, and their cargos trans-shipped to smaller tankers upon reaching a destination. Only after a portion of the cargo is transferred are the super tankers able to unload at their regular terminals.

The Suez Canal, a natural course for tanker shipments of Middle East oil products, will accommodate ships with a maximum draft of up to 36 feet, or ships of 38,000 dwt and less.

Working end of the sea loading line before it was installed in the Bay of Bombay. The pipe is 24-inch concrete-coated, ½-inch wall. The two flanges (15-inch) were connected to two 10-inch heavy duty neoprene rubber hoses.

The Collins rubber tire launchway. Way can be extended over any distance. The pipe moves over it practically friction free without any stress to the pipe or to the protective coating. The pontoons banded to the pipe offer bouyancy which can be figured to give positive flotation or negative bouyancy.



Entire sea-loading line (2,600 feet) in tow across the Bay of Bombay. This particular installation was made by using Collins patented flotation method.

With the tremendous production increase in that area during the past few years, and with the world's increasing dependence on the proven oil reserves of the Middle East, tanker traffic from the Persian Gulf area to Europe and to other parts of the Western world, is certainly expected to be increased.

The bulk of the oil coming from the Middle East at present is being routed through the Suez Canal. Super tankers, 45,000-ton or less, partially loaded, can transport crude through the Suez at a cost below that of making the long haul around the Cape of Good Hope, Africa.

Super tankers of 65,000-ton capacity can take the Cape route with a full load, and realize a saving of a few cents per barrel over the cost of transporting through the Suez partially loaded. An 80,000-ton tanker can save considerably more per barrel by transporting around the African Continent.

Since Colonel Nasser's recent seizure of the strategic waterway, the oil companies of the Middle East who have large investments at stake, are becoming troubled over the future of Canal rights.

Colonel Nasser's grip on the Suez gives him complete control over tanker shipments of Middle East oil through the most direct water route to Europe and other Western nations.

Coupled with the Arab control of overland pipe line rights-of-way to the Mediterranean, this political maneuver looms as a serious threat to a continuing free flow of petroleum from the Middle East to Western nations.

The importance of Middle East production, and of the vast oil reserves of that area, to England, France, and other Western nations, is unquestioned. The industrial progress of Western Europe has become wholly (up to 85%) dependent upon the vital oil production of Kuwait, Saudi Arabia, Iran and Iraq.

Although the intended purpose of the super tankers was supposedly to transport crude from the Persian Gulf, through the Pacific to the California coast, they are currently being used almost exclusively for transporting crude around the Cape to European refineries.

The large number of super tankers under construction and on order is expected to provide Western nations with an alternate means of continuing the movement of crude to their refineries in the event that Colonel Nasser places undue levies on Suez cargos, or makes unfair demands of the Western oil companies operating in the Middle East.

Thus, the super tanker, and the Cape route, aside from being a more economic means of transporting oil, are also a means of insurance for Western nations in keeping the flow of Middle East petroleum moving to Western Europe.

Colonel Nasser's political move has no doubt strengthened the future of super tankers. Today, only 4% of the West's imports of Middle East oil is being shipped around the Cape.

When more of the super tankers move into operation, this figure could rise to 20%, or even 50%, regardless of the political action taken by Colonel Nasser in regard to the Suez.

The trend toward super tankers is substantiated by these facts. They are definitely on the way, and they bring with them a problem of significance, mentioned earlier.

In a recent meeting between government officials and oil companies in Wales, the proposal for a "super terminal" to accommodate the planned giant oil carriers was discussed.

The specific plan called for the building of docks at Milford Haven to take 100,000-ton tankers. It was presented by the Milford Haven Development Committee. Cost of the scheme is estimated as ranging between $36.4 million and $42 million. Accommodations for larger super tankers of the future were not discussed.

Being considered by some authorities is the installation of a submarine sea-loading line to handle giant tankers of any capacity.

Since this type of facility is relatively new, many of its advantages are not known over the world, and consequently, few have given serious consideration to the installation of such a system.

Actually, there are many sea-loading and unloading lines being successfully utilized today. They have proven to be a faster, safer, and more economical means for taking on and discharging petroleum.

The seemingly impossible challenges presented by such an installation have been largely responsible for the reluctance toward attempts to construct a sea-loading facility. Tricky tides, raging waves, high winds, depths up to 100 feet, and lack of proper equipment are some of the most significant hazards barring attempts in the past.

Through the development of specialized techniques, equipment, and methods of installation in recent years, however, these hazards have been overcome, and the entire operation has become relatively simple.

One American contractor has completely mastered these techniques for his own operations, and has also contributed many new equipment designs and installation methods to the industry which have revolutionized the procedure to the extent that highest quality work can be done in the installation of sea-loading lines.

The pioneer in the development of the methods and equipment mentioned above is the Collins Construction Co., a firm in South Texas which deals exclusively in the installation of submarine pipe lines throughout the world.

Collins installed two of the world's first permanent type submarine sea-loading lines—one in India, and another in Africa. Both lines were laid from shore to a depth of 60 feet. Both were concrete coated, given cathodic protection, a protective coating, and laid on the bottom, unburied. These lines are expected to give service for a minimum of 50 years.

As soon as the sea loading line was positioned, all flotation equipment was removed allowing the line to attain its full negative buoyancy, settling permanently into position on the bottom.

The "Tagelus" of London, a T2 type on 38,000 dwt class tanker is shown as it maneuvered into position for mooring to the Navy type buoys preparatory to bringing the submarine sea loading facilities on board.

The sea-loading line installed by Collins in Africa was 2½ miles in length. The actual installation of the sea-loading facility required only five days. The line is currently being used for unloading petroleum products for local consumption. It is the only sea-unloading facility on the Gold Coast at present. The line replaced a temporary unprotected line installed during World War II by military forces which was previously used for unloading tankers standing offshore.

With its protective coating, the sea-unloading line in Africa is expected to give maintenance free service for a period of 20 years although not buried beneath the bottom. The useful service life of the line will be much longer.

The 2,500-foot sea-loading line in India's Bay of Bombay, for unloading crude carriers for the Burmah-Shell refinery, was installed in 3½ hours.

The installation of anchorage facilities and the attachment of flexible neoprene hoses for connecting to the tanker outlet, was accomplished in three days.

The sea-loading systems were the world's first permanent type installations. In the past two years, others have been installed in various parts of the world, and are also proving to be successful ventures. Collins is currently making a sea-loading installation for government agencies in the Bay of Biscay, France.

The saving of $30 million to $40 million on a single project cannot be regarded lightly, especially since the recent tightening of the money market, and the resultant higher interest rates.

The above figure represents the approximate amount that could be saved by the installation of a sea-loading system, as compared to the enlargement of harbor facilities, to accommodate the new super tankers being built.

An approximate expenditure of $42 million, for example, which was the estimate for one harbor enlargement proposal, could be reduced to an approximate $4.2 million, with the same result being accomplished.

Giant tankers, rather than be squeezed into congested harbors, could be moved into a sea-loading berth one mile, five miles, or 10 miles at sea, attach submarine hoses, and either take on or discharge its cargo through submarine lines to a tank farm or storage area on shore.

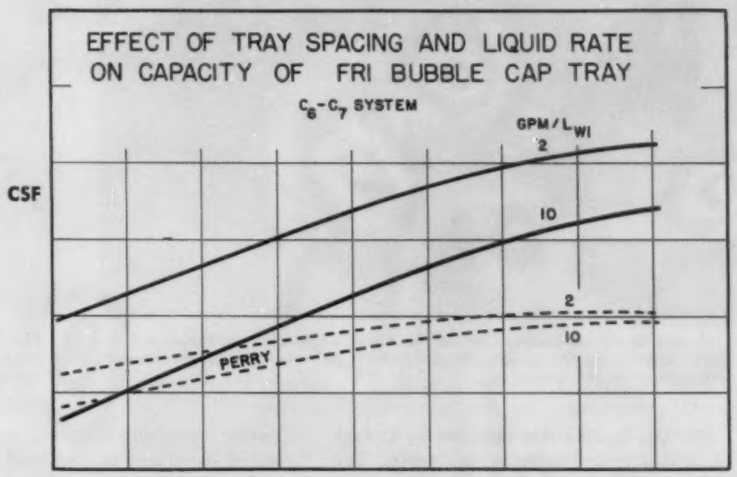
It is suggested that this type of installation be completed with the seaward end of the pipe at a minimum depth of 60 feet. It is also suggested that four 10-inch hose be attached for either loading or unloading facilities. In this manner ships of the "World Glory" class or bigger can discharge at a maximum rate with a minimum turn around time. It is also necessary that these facilities be completely seaworthy under the most extreme circumstances. Engineering figures and marine recommendations have shown that minimum holding power using a Navy type Danforth anchor should be 20,000 pounds. Four or more anchors are considered necessary. To have a constant holding power, these anchors should be jetted to a sufficient depth below the bottom surface, using recommended Navy type mooring for ships in the 60,000 to 80,000-ton class. A subordinate concrete anchor should be placed on the mooring line to keep a constant strain on the anchor. In this way the mooring buoy can swing on the surface without dislodging its initial anchor or losing its holding power. Lengths of 2⅝-inch stud link chain are adequate to connect a buoy to its buried anchors. These moorings can be placed according to prevailing winds and established currents, tidal or otherwise so the ship can moor in any direction. A small power launch is all that is necessary to run the mooring lines to the buoy. Once the ship is secured, it is a small matter for the ship's boom to reach over the side. Again, the mooring launch or power launch is used to bring the hose buoy into position underneath the boom. The buoy is hooked with the boom line and as the hose buoy is brought aboard the ship, its connecting cable is in turn connected to the hose. Once the hose is brought aboard, the cap or blind flange is removed and the hose is connected directly into the ship's pumping facilities. While one section of hose is being connected, the hook line can in turn bring the other section of hose aboard and can be connected in the same manner. This total operation

(*Continued on page* 116)

One of the neoprene hoses being brought on deck. To the left on deck is the hose marker buoy and still floating in the water is the marker buoy indicating the end of the sea loading line.

The ship's boom was used to maneuver the hoses into position alongside of the discharge valves on deck of the "Tagelus." As soon as the hoses were in position and flanged up, radio contact was made with the shoreward end to open the valves and pumping operations were underway.

Fifty-four oil and engineering companies are engaged in a co-operative study of fractionation through Fractionation Research, Inc. Results of research to date indicate that towers in the past have been greatly overdesigned. Using FRI data future construction costs will be very greatly reduced.



FRACTIONATION RESEARCH PAYS OFF

By F. W. Winn

For many years the design of distillation columns and absorbers has been based on information which is not always dependable. As a result the practice has been to design columns with very high safety factors. Some columns have been operated above their "design" rates by 200% or more while others have fallen far short. Although a few improvements in design procedures have come about in recent years, the reliability of current design procedures still leaves room for vast savings in capital investment and operating expenses.

That significant reductions in column costs are possible has long been recognized. However, because meaningful data can best be obtained only in industrial size equipment with systems similar to those used in commercial practice, the cost of such work is inherently expensive and difficult to justify for an individual company.

The obvious solution to this problem is a cooperative research effort. Thereby each participant can obtain all of the benefits at only a small fraction of the total cost. Fractionation Research, Inc., a non-profit corporation, was organized for this purpose—to conduct distillation research in commercial size equipment.

Companies participating in the support of Fractionation Research, Inc., receive all technical information and are granted royalty-free patent rights on each patent owned or controlled by FRI. No company is obligated to disclose to FRI any of its technical information. At the present time there are 54 companies in the chemical, petroleum, natural gasoline, engineering and construction industries which participate.

The objectives of FRI are to develop methods for predicting the capacity, efficiency, and operating characteristics of all promising types and designs of vapor liquid contacting devices. The data developed by FRI are being used to revamp presently operating equipment for increased capacity and efficiency, and to specify new columns with trays of the best type and design for any particular service.

Francis W. Winn, technical director of Fractionation Research Inc., is a chemical engineer graduate of the University of Oklahoma with a background of oil and engineering company experience. He was connected with the Petroleum Administration for War during World War II and has been a staff engineer for Pan American Petroleum Corp., Socony Mobil Oil Co. and Catalytic Construction Co.

The research and development program is being carried out in a commercial size research distillation unit and a large simulator and in industrial columns of stockholder companies. Figure 2 is a photograph of the distillation and simulator units located at Alhambra, California. The distillation unit, shown on the right, is owned by FRI. The simulator is owned by C. F. Braun & Co.

The distillation unit is four feet in diameter and has a shell length sufficient for 10 trays on 2-foot spacing. It is equipped with a removable head to facilitate rapid tray changes. Craftmen, operators, analytical personnel and other necessary services are provided by C. F. Braun & Co. The column usually is operated three shifts, five days each week. A complete series of runs with two systems can be completed in this time interval.

This distillation unit may be operated as either a stripper or a rectifier. It is used to investigate flooding, pressure drop, entrainment, hydrostatic pressures, and efficiency characteristics of vapor-liquid contact devices as a function of tray spacing, liquid and vapor load, pressure, and system properties. Windows are provided in the top head and the shell for observations of tray action.

The systems being studied are n-butane/isobutane, n-heptane/cyclohexane, isoprop-

anol/water, carbon tetrachloride/propylene dichloride, n-pentane/absorption oil with steam, and water/steam. These systems cover a very wide range of system properties. In the future, additional binary systems and multi-component systems will be investigated. Pressures currently used are 200 mm mercury absolute to 165 pounds per square inch absolute. Provisions have been made for studies at pressures down to 5 mm mercury.

Bubble cap trays and perforated trays both with and without downcomers are being studied extensively. Two proprietary devices, the Socony-Mobil Uniflex tray and the Koch Flexitray, are currently being investigated.

Certain devices to be tested in the distillation unit are first screened in the simulator. The simulator, shown on the left side the accompanying photo, is a 66-inch diameter, three-tray column. It is used to obtain the same information as the distillation unit with the exception of tray efficiency. In addition downcomer buildup and vapor distribution data are obtained. Systems such as absorption oil, hexane, or water with nitrogen, carbon dioxide or natural gas are used.

Arrangements have been made with stockholder companies to test a large number of tray designs and systems in commercial towers ranging in diameters up to 13 feet. Commercial tower data will be used to scale up the experimental unit data and to check efficiency correlations on systems which cannot be studied in the experimental unit.

Some FRI results published methods for sizing bubble cap towers are notoriously generous with tower area. The accompanying graph shows the capacity of an FRI bubble cap tray plotted against tray spacing for liquid loads of two and ten gallons per minute per inch of weir length. For comparison the "maximum allowable" capacity from Perry's Chemical Engineers' Handbook is also plotted. The capacity data from Perry are similar to other published information on this subject.

The ordinate of the graph, labelled CFS, is the superficial vapor velocity at flooding conditions times the square root of the ratio of vapor to liquid densities. Actual numbers have been omitted from the coordinates to avoid revealing confidential data. The graph illustrates two things: (1), that published capacity data are not reliable and (2), that the increase in capacity with increasing tray spacing is much greater than commonly believed. This information will change the economics of tray spacing considerably.

Most published design procedures indicate that high weirs cause a substantial reduction in capacity. FRI studies have shown that the capacity of a bubble cap tray on 24-inch tray spacing with 6-inch weirs is essentially the same as with 2-inch weirs. The increase in pressure drop from a 4-inch increase in weir height is not four inches of liquid as most authors would predict but rather only about 1.5 inches.

Experimental columns used by Fractionation Research Inc. Four-foot distillation unit is shown (right) and 5.5 simulator unit (left).

FRI also has carried out extensive studies of perforated trays without downcomers. The term Dualflow has been coined to describe these trays, which pass both liquid and vapor through the same holes.

Dualflow trays of the proper open area have a considerably higher capacity than bubble cap trays and their maximum efficiency is as high as that of bubble cap trays. However, they have one serious limitation —the lack of flexibility for some systems. Their efficiency with the n-butane/isobutane system is 100% or higher at vapor rates from 40% up to 99% of flooding rate. This is suitable for most deisobutanizer installations. However, for the isopropanol/water and n-heptane/cyclohexane systems, efficiencies comparable to that of the bubble cap tray are obtained only at vapor rates from 70% up to 99% of the flooding rate. Recent studies have shown that Dualflow trays may be very well suited to high vacuum applications.

Another type tray under study is the sieve tray or perforated tray with downcomers. As with bubble cap trays, it has been found that published information on sieve trays is not always reliable.

Research data developed by FRI are worked up by a staff of four engineers. This information, in the form of correlations and design procedures, is forwarded to participants in monthly progress reports and topical reports.

The information already obtained has been used in recent column installations with resultant savings to one stockholder of hundreds of thousands of dollars. However, a large amount of research remains to be done before all aspects of the performance of various types of contactors are defined fully. The ultimate savings will pay out the cost to each participant many times over. In the future, the American public will obtain higher quality products at lower prices as a direct result of this cooperative research in fractionator design.

Participating Companies in Fractionation Research, Inc.

Anderson-Prichard Oil Corp.
Ashland Oil & Refining Co.
Bechtel Corporation
C. F. Braun & Co.
Brown & Root, Inc.
Catalytic Construction Co.
Carbide & Carbon Chemical Co.
The Chicago Corporation
Continental Oil Company
Delhi-Taylor Oil Corporation
The Dow Chemical Company
Dresser Engineering Co.
Eastern States Petroleum Co.
The El Dorado Refining Co.
El Paso Natural Gas Co.
Ethyl Corporation
The Fluor Corp., Ltd.
Gasoline Plant Construction Corp.
Fritz W. Glitsch & Sons, Inc.
The Globe Oil & Refining Co.
Hudson Engineering Corp.
Husky Oil Company
The M. W. Kellogg Company
Kendall Refining Co.
Kerr-McGee Oil Industries, Inc.
Keystone Oil Refining Co.
Koch Engineering Co.
Koppers Company, Inc.
Lone Star Producing Co.
The Lummus Company
Arthur G. McKee and Co.
Monsanto Chemical Company
The C. W. Nofsinger Co.
The Ohio Oil Company
Oriental Refining Co.
The Ralph M. Parsons Co.
Phillips Petroleum Company
J. F. Pritchard & Company
Refinery Engineering Co.
Richfield Oil Corporation
Rock Island Refining Corporation
Roosevelt Oil & Refining Corp.
The Rust Engineering Company
Socony-Mobil Oil Company
South Penn Oil Company
The Standard Oil Company (Ohio)
The Stearns-Roger Mfg. Company
Stratford Engineering Corp.
Sunray Oil Corporation
Tears Engineers
Tidewater Oil Company
United Gas Pipe Line Co.
Universal Oil Products
Warrent Petroleum Corporation—END

THE FOUR CORNERS AREA

By Tom Dougherty, Petroleum Information, Denver

IN 1861, southeastern Utah was described as "Only fit for Indian hunting grounds and to hold the world together."

Today southeastern Utah is the site of what promises to be one of the most significant onshore oil developments in the United States during the past decade.

Sharing new importance with southeastern Utah are northeastern Arizona, southwestern Colorado and northwestern New Mexico—the "Four Corners" area. The name comes from the common corner of these four states.

Within the Four Corners district lie the Paradox and San Juan Basins. Oil exploration began in both about the turn of the century. The first wildcat well drilled for oil and gas in northern New Mexico was drilled near the present city limits of Farmington in 1907. In Utah oil was discovered in the Mexican Hat area near the Goosenecks of the San Juan River in 1908. Thus the oil history of the two basins dates almost as far back as that of any other Rocky Mountain area.

Intensive exploration and development has lagged behind that of other Rocky Mountain oil provinces—until the past few years. Now the major focus of Rocky Mountain oil and gas interest is upon the two basins. The major Rocky Mountain discoveries of the past two years have been made in the general Four Corners area.

Some oil was found in Cretaceous beds in the San Juan Basin from 1921 to 1929. Gas development there has been important for a number of years, although the basin's position as a substantial gas province did not become apparent before Southern Union Gas Co.'s discovery at Barker Creek Dome in 1945.

Substantial interest in oil possibilities of the San Juan did not develop until the discovery of Bisti field in 1955.

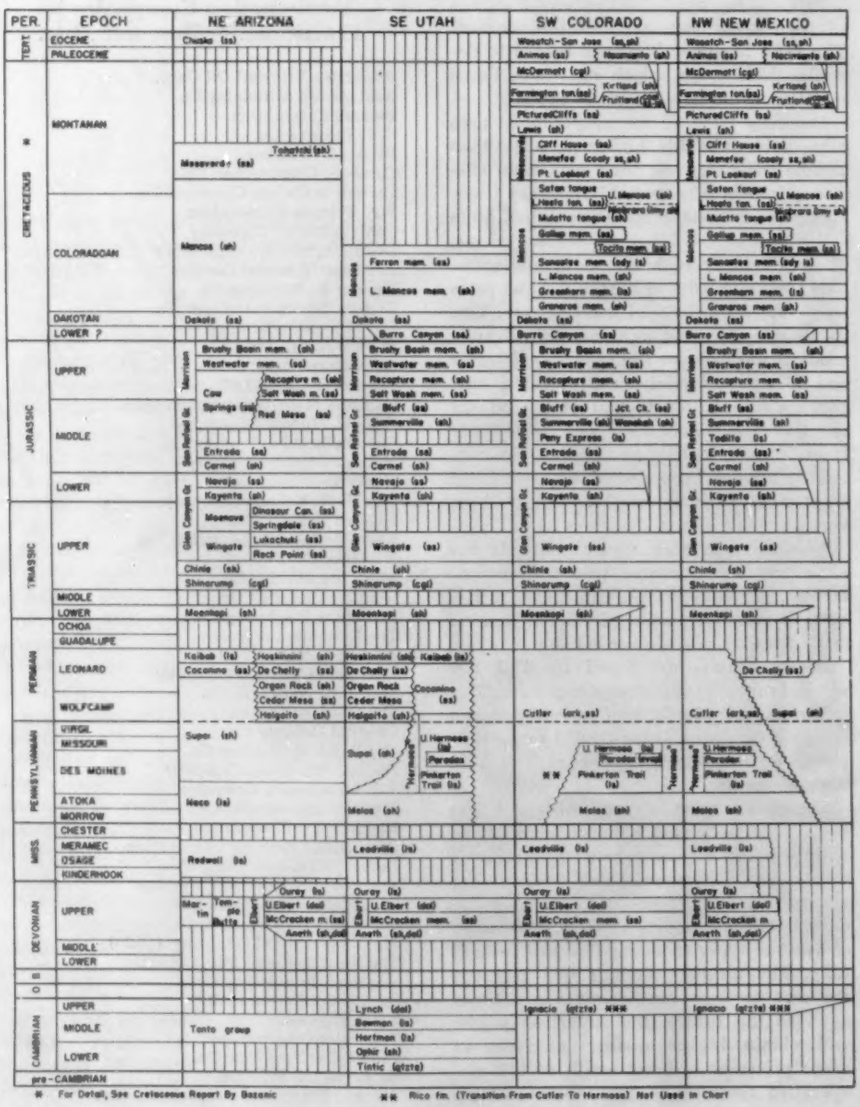
The Paradox Basin had desultory drilling from 1900 to 1954. Almost every well had shows of either oil or gas or both, but no discovery of substantial merit was made until 1954.

Shell Oil found production in the Paradox member of Pennsylvanian Hermosa at Desert Creek, north of the old Boundary Butte field on the Navajo Indian reservation in 1954. Drilling in the basin stepped up following that discovery. Discoveries followed in 1954 at North Boundary Butte and at East Boundary Butte in Apache County, Arizona.

In 1955, El Paso Natural Gas completed an oil discovery producing from the Gallup sandstone member of Mancos on the western side of the San Juan Basin southwest of the Blanco gas field in New Mexico. The discovery attracted intense interest as evidenced by a bonus bid of $726 per acre for a quarter-section of land in the area at a Navajo Indian lease sale late in the year. Substantial development did not begin at Bisti until early 1956. By mid-year drilling had indicated a producing area approaching 20,000 acres and recoveries ranging from 30 million barrels upward were predicted.

In February of this year, The Texas Co. completed a discovery in section 23-40s-24e in the Aneth area of San Juan County, Utah, for a flow of 1,704 b/d of 43 gravity oil from a 46-foot section of Paradox at 5,828 feet. This was the best gauge ever reported in the Paradox Basin, indeed in the entire Four Corners area.

Development at Aneth was immediate.



Nomenclature Chart of the Four Corners Area.

Further drilling by The Texas Co. and by Superior Oil resulted in completions ranging from 400 to 1,800 b/d.

In mid-September, The Texas Co. tested a wildcat nine miles east of existing production at Aneth and completed it from Upper Hermosa, above the Paradox member, for 1,420 b/d.

While this well was testing, Shell oil also found Upper Hermosa production at Recapture Creek, five miles west of existing limits of Aneth field. This well flowed at the rate of 17 barrels per hour before shut in for lack of market outlet.

Recapture Creek was the second wildcat success for Shell in this area. Shortly before the Recapture Creek discovery was tested, Shell completed a discovery in the North Desert creek area in section 12-41s-23e, three miles north of Desert Creek field and five miles south of Aneth. It flowed 1,440 barrels of 42 gravity oil per day.

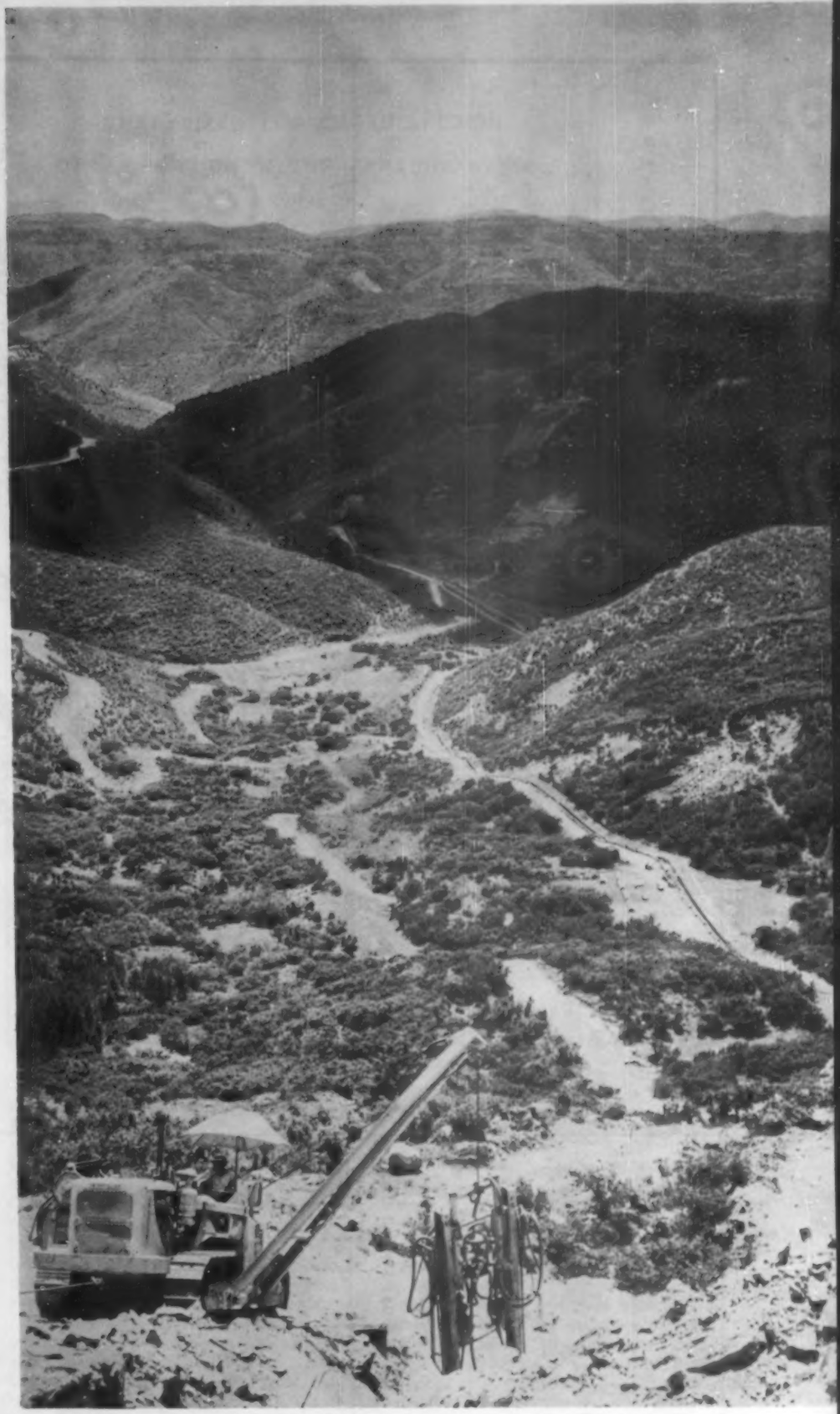
By October 1, Aneth field had 15 producers. One dry hole a mile and a half east of production was the only failure in current operations in the area. Discoveries east and west of the field extended the axis of production over 18 miles, and from Desert Creek to Aneth the north-south axis of production was approximately 11 miles. Production is small due to limited market, and little production history is available. Nevertheless, off-the-cuff estimates of recoverability of 10,000 to 30,000 barrels per acre at Aneth have become common in the region.

While this southeastern Utah area was developing, success was also reported in Arizona and extreme northwestern New Mexico. Four miles south of Boundary Butte, Franco-Western Oil of Bakersfield completed a 7,450,000 cubic foot per day gas discovery in section 22-41n-28e, Apache County, Arizona.

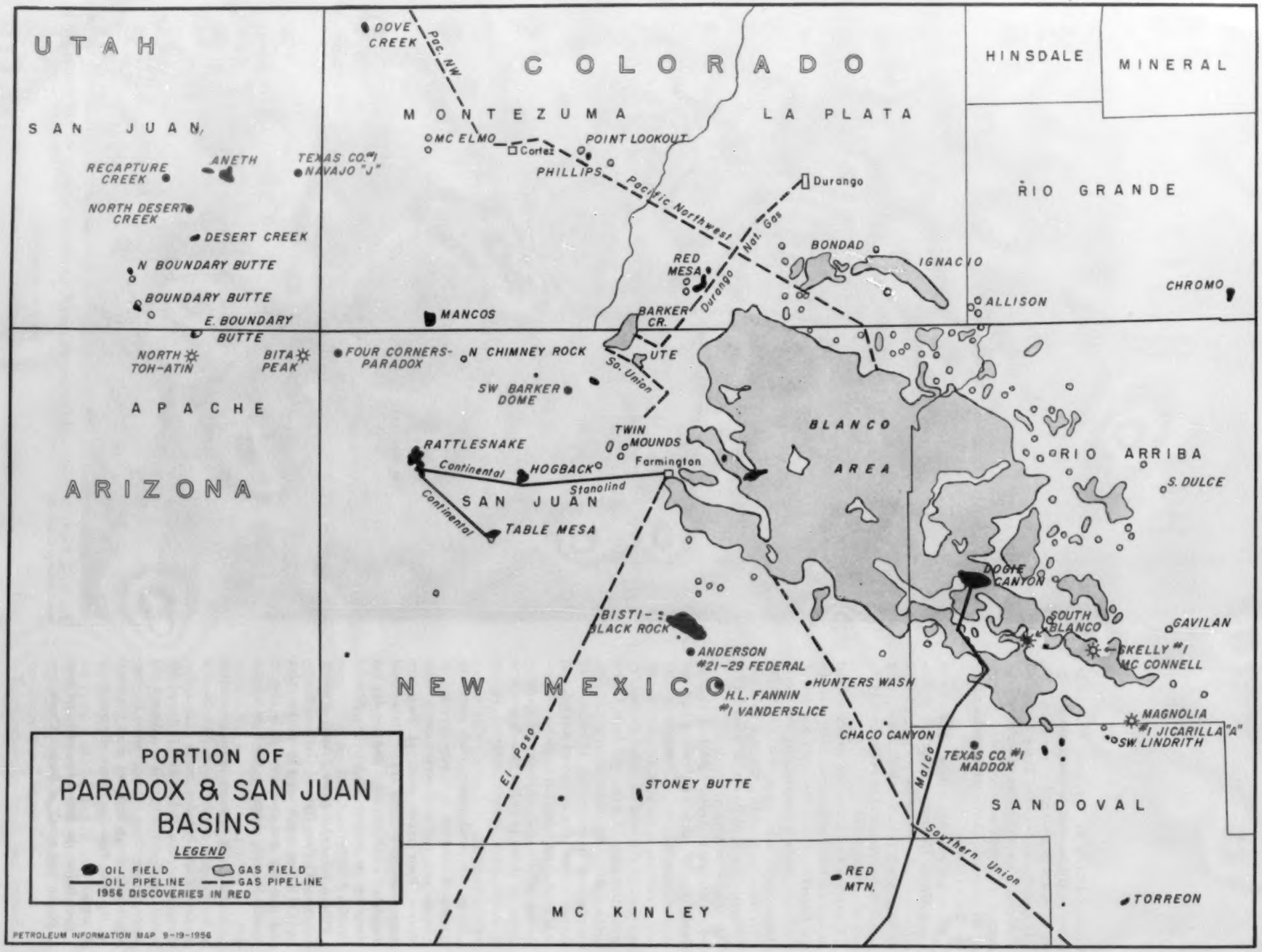
Fifteen miles east of the Franco-Western discovery El Paso Natural Gas and Stanolind Oil & Gas completed a 20-million cubic foot per day gas discovery. It is also in Apache County, almost on the New Mexico line.

Humble Oil & Refining found production in the extreme northwestern New Mexico portion of the Paradox Basin with a discovery in section 29-32n-20w. It flowed 385 barrels of oil and 43 barrels of sediment and water per day from Pennsylvanian through a half-inch choke. It is five miles northeast of the El Paso-Stanolind discovery in Arizona.

Even before the discoveries east and west of Aneth and north of Desert Creek, re-



The Pacific Northwest Pipeline under construction through mountainous country in the Four Corners area in southwestern Colorado.


UTAH
COLORADO
NEW MEXICO
ARIZONA
SAN JUAN
MONTEZUMA
LA PLATA
HINSDALE
MINERAL
RIO GRANDE
RIO ARRIBA
SANDOVAL
MC KINLEY
APACHE
DOVE CREEK
Pac. NW
MC ELMO
Cortez
POINT LOOKOUT
PHILLIPS
Pacific Northwest Nat. Gas
Durango
RECAPTURE CREEK
ANETH
TEXAS CO. #1 NAVAJO "J"
NORTH DESERT CREEK
DESERT CREEK
N BOUNDARY BUTTE
BOUNDARY BUTTE
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NORTH TOH-ATIN
BITA PEAK
RED MESA
BONDAD
IGNACIO
CHROMO
ALLISON
MANCOS
BARKER CR.
Durango
FOUR CORNERS-PARADOX
N CHIMNEY ROCK
UTE
So. Union
SW BARKER DOME
TWIN MOUNDS
RATTLESNAKE
Continental
HOGBACK
Farmington
Stanolind
Continental
SAN JUAN
TABLE MESA
BLANCO AREA
S. DULCE
DOGIE CANYON
BISTI-BLACK ROCK
SOUTH BLANCO
GAVILAN
SKELLY #1 MC CONNELL
ANDERSON #21-29 FEDERAL
HUNTERS WASH
H.L. FANNIN #1 VANDERSLICE
MAGNOLIA #1 JICARILLA "A"
SW. LINDRITH
CHACO CANYON
TEXAS CO. #1 MADDOX
Malco
El Paso
STONEY BUTTE
Southern Union
RED MTN.
TORREON
PORTION OF
PARADOX & SAN JUAN BASINS
LEGEND
OIL FIELD
GAS FIELD
OIL PIPELINE
GAS PIPELINE
1956 DISCOVERIES IN RED
PETROLEUM INFORMATION MAP 9-19-1956

serves of the order of 200 million barrels were being credited to the Four Corners area by some observers.

These are the recent developments which have set the stage for widespread participation in a large scale exploration and development program in the Four Corners area.

The stage has been so well set and interest fanned so high that on October 1 more than seven and one half million dollars was paid in bonus at sales of leases of lands of the Ute Indian reservation in southwestern Colorado and Northern New Mexico. High bonus bid was $601 per acre. A total of 53,120 acres was leased. None of this acreage was closer than 20 miles to the Aneth field, or other recent major developments in the area.

Indian reservations cover much of the Four Corners area. The Ute reservation in southwestern Colorado, northwestern New Mexico, and the Navajo reservation of 15 million acres in southeastern Utah, northeastern Arizona and northwestern New Mexico, are the most strategically located. The Jicarilla Apache reservation in northern New Mexico is also important. More than half its 741,000 acres are now under lease.

Availability of federal and state lands, and Indian sales in the past, have contributed to the widespread participation of major companies in leaseholdings through the Four Corners. At the present time the only large blocks of acreage open are Indian lands. Forthcoming lease sales will offer continuing evidence of industry evaluation of the area.

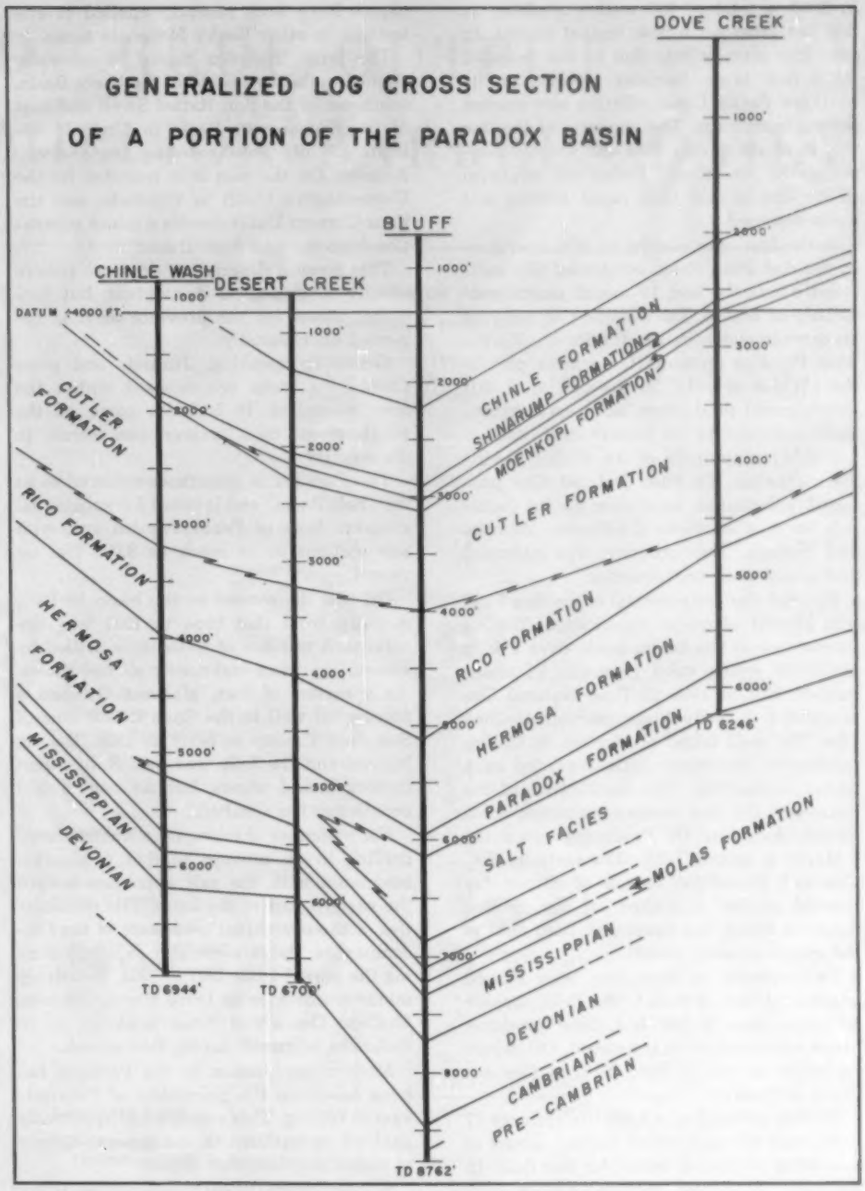
The geological and tectonic components of the Four Corners area are complex. To bound and define current developments within the area it is sufficient to consider the Paradox and San Juan basins only as the terms are used in general discussion.

Of these two basins, the significant development history of the San Juan is longer. The San Juan Basin is an irregular circle of 15,000 to 20,000 square miles in area. It includes all of San Juan County and parts of McKinley, Rio Arriba, Sandoval, Valencia and Bernalillo Counties, New Mexico. The northern portion of the basin occupies parts of several counties in southern Colorado. Tertiary and Cretaceous rocks are exposed throughout the San Juan.

Some pre-Cretaceous drilling has been done in the basin, with some small oil production found in the New Mexico portion and substantial Pennsylvanian gas production in the Colorado portion. However, the principal development in the San Juan is to Cretaceous formations.

The first oil discovery in the state was made at Seven Lakes in 1911. It was accidental since the well was intended for water. In 1920, gas was discovered in the Farmington sandstone near the town of Aztec and the first pipeline in the area took this gas to the town.

Midwest Refining (Stanolind Oil & Gas) found gas at Ute Dome in 1921. The company's second well in this area made 37-



million cubic feet of gas per day from Dakota sandstone.

In 1921, oil was found at Hogback and in 1924 oil discoveries were made at Bloomfield, Rattlesnake and at Red Mountain in Colorado. A three-inch pipeline was completed from Hogback to Farmington. Refineries were completed at Aztec, Bloomfield and Farmington in 1925, and gas was discovered at Barker Creek in the same year.

In 1926, gas was discovered at Blanco and at Hospah. Gas discoveries at Kutz Canyon and at Fulcher, and oil at Mancos Creek, Colorado, followed in 1927. The next year oil was discovered at Stoney Butte. Pennsylvanian Oil was found at Rattlesnake in 1929.

During the depression years activity was at a low ebb, although a few scattered discoveries were made. The Barker Creek gas discovery in 1945 was the highlight of the period from 1929 to 1946.

In 1946, the extension and development of the Blanco gas pool was begun with development to Pictured Cliffs, Mesaverde and Dakota. The extent of this development can be appreciated by the fact that by 1955 more than one million acres within the 6,000 square mile extent of Pictured Cliff deposition in the central basin had been proven productive. This does not necessarily include the limits of Mesaverde production. Development to this formation is relatively recent.

In 1950, El Paso Natural Gas received approval for a proposed pipeline to take San Juan Basin gas to southern California markets. Drilling steadily increased from 1946 to 1953 as a result of the new outlet.

In 1953, a total of 636 wells completed in the San Juan set a new annual record. In part this activity was due to the proposal for a new large diameter pipeline to the northern Pacific Coast, offering new market for the basin's gas. The approval of the line was in doubt during 1954 and activity consequently decreased. Following approval of the line in mid-1955, rapid drilling was again resumed.

In the first nine months of 1956, operators in the San Juan Basin completed 631 wells —more than the best 12-month period previously of record. Development of reserves on acreage committed to the Pacific Northwest Pipeline accounts for a large part of the present activity. In the course of this development production has been substantially extended to the eastern basin area.

Following approval of the Pacific Northwest Pipeline, El Paso Natural Gas proposed substantial expansion of its facilities serving southern California, Arizona and Nevada. This program was approved and is now under construction.

By 1956, the gas potential of the San Juan was proved of major significance. The oil discoveries in the basin, made over a long period of years, were generally of minor caliber. But in 1955 El Paso Natural Gas completed 1 Kelly-State, section 16-25n-12w. The well found production in Gallup sandstone, previously little regarded as a potential reservoir. The significance of the discovery did not become apparent until British-American Oil Producing completed 1 Marye in section 1-25n-13w early in 1956. The well flowed 595 barrels of oil per day through choke. It kicked off the drilling program which has developed Bisti field to the extent already noted.

Development at Bisti has been slowed because of lack of outlet. The field, capable of more than 15,000 b/d, now produces about one-tenth of that amount. Oil moves by truck to the El Paso Natural Gas refinery at Prewitt.

El Paso is building a 6,500 b/d refinery 17 miles east of the town of Gallup, aimed at providing additional outlet for this field. In addition, Northwest Pipeline Co., a subsidiary of Pacific Northwest Pipeline, proposed a 15,000 b/d pipeline from northwestern New Mexico to refineries at Salt Lake City. The line, in addition to handling natural gas liquids from production credited to Pacific Northwest Pipeline, proposed to take crude from Bisti as well as from fields in southeastern Utah. Right-of-way operations for this line have been begun, but plans were not finalized at the 15,000 b/d volume. The line will be built for 25,000 b/d with further expansion possible.

In addition to its gas potential and its developing oil reserves, the San Juan Basin has contributed to development of other Rocky Mountain areas. The techniques of drilling with gas and with compressed air and of sand-fracturing with high volumes of sand and oil were early put to use in the basin, replacing the earlier uses of shooting with high explosives and the expensive use of mud as a circulating medium. These techniques have been recently applied to advantage in other Rocky Mountain areas.

The term "Paradox Basin" is generally applied to the area south of the Uinta Basin, southeast of the San Rafael Swell and east of the Kaiparowits Basin in Utah. It extends slightly into extreme northeastern Arizona. On the east it is bounded by the Uncompaghre Uplift in Colorado, and the Four Corners Uplift creates a minor separation from the San Juan Basin.

This general description does not adhere strictly to geological description, but furnishes limits for the province as it is regarded operationally.

Generally speaking, Jurassic and some Cretaceous rocks are exposed within the area described. It includes some of the roughest and most undeveloped terrain in the country.

The Paradox is sometimes referred to as the "Salt Basin" and is noted for substantial evapoite beds of Pennsylvanian age, with salt sections of as much as 8,000 feet on record.

Oil was discovered in the basin in 1907. Activity from that time to 1951 was desultory. A number of wells were drilled by several operators and nearly all had shows. As a matter of fact, Midwest Oil had a flowing oil well in the Cane Creek area of San Juan County as early as 1928. The rig burned and the hole was lost. Subsequent drilling found shows but no commercial completion has resulted.

For a number of years there was scattered drilling in an attempt to find production associated with the salt anticlines toward the eastern part of the basin. The possibilities of the overthrust area west of the Uncompaghre Uplift were also explored during the period from 1907 to 1951. Relatively minor discoveries at Dove Creek, Mancos, McElmo Dome and Point Lookout, all in Colorado, occurred during this period.

Modern exploration in the Paradox has been based on the possibility of Pennsylvanian reefing. This concept has apparently paid off as outlined in the general history of recent developments above.

Some oil from the early—North Boundary Butte, Desert Creek—discoveries moved to small New Mexico refineries. With the development of Aneth field new outlet became important. The Texas Company negotiated a market for 2,000 barrels per day of much higher productive potential at Aneth. Oil is trucked to Thompson, Utah, and sent by rail to Salt Lake City.

The proposal for a crude line to Salt Lake City is vitally important to the development of southeastern Utah. In addition, discussion has been held on the possibility of a line to the Los Angeles area. More than 20 operators considered this possibility at a 1956 meeting in Denver. Further consideration, despite the plan for a line to Salt Lake City, is scheduled for the near future. Reserves of 200 million barrels or more will require outlet greater than that available through present refinery capacity within the Salt Lake City area.

A majority of major operators and a number of independents are represented in Four Corners operations.

Early development of the San Juan Basin involved Stanolind Oil & Gas, Southern Union Gas, Continental Oil, Gypsy Oil (Gulf), Standard Oil of Texas, El Paso Natural Gas, Byrd-Frost, Magnolia Petroleum, Aztec Oil & Gas and others. Modern operations there have seen the entry of Phillips Petroleum, Skelly Oil, Humble Oil & Refining, The California Company, British-American Oil Producing, Amerada Petroleum, Sunray Mid-Continent, Shell Oil, Kerr-McGee, Blackwood & Nichols, Northwest Production (Pacific Northwest Pipeline) and Atlantic Refining, among others.

Nearly all these companies listed above control holdings in the Paradox Basin. In addition, Ohio Oil, Carter Oil, Texota Oil, International Metals Corp., Utah Southern Oil, Standard Oil of California, Tennessee Gas Transmission and others must be added when Paradox Basin operators are mentioned.

The investment in federal, state, Indian and free lands in the Four Corners area is very large. In addition to the companies which acquired holdings during the past few years, others are seeking lands in both the major basins now under development in the Four Corners area. Performance at Indian sales in the past is the surest clue to operator interest for these basins.

By way of illustration, the Navajo tribe has leased approximately 1.1 million acres of the total of 15 million within the reservation. The average bonus bid is a little more than $14.00 per acre. The highest bid offered for Indian lands in the Paradox Basin prior to 1956 was $129.05 paid by Shell Oil for southern Utah lands in 1952. Contrast this with the $601.00 per acre recently paid by The California Co. for lands more than 20 miles from a major development.

By the end of September of 1956 operators in Utah had already drilled more wells than in all of 1955. The 1956 total should not be more than 50% of Utah's drilling in 1957.

While a considerable amount of drilling has been done in the gas producting areas of the San Juan Basin, production is by no means outlined and portions of the basin must be regarded as sparsely drilled.

The Utah, Arizona and Colorado areas of the Paradox Basin are among the most sparsely drilled areas within the Rocky Mountain region, which contains no major area which may be classified as heavily drilled. But, in spite of widely scattered operations, the basin is already established as a substantial producing province. At the moment it overshadows the Williston Basin which was the commanding area of new activity in the Rockies from 1951 until 1955.

During November, 365,000 acres of Navajo lands within the Paradox and San Juan basins will be leased at sealed bid sale. The sale includes lands extremely well located with respect to recent discoveries—giving many operators an opportunity to put a price tag on the Four Corners play. END

WORLD CRUDE OUTPUT NEARING 17 MILLION BARRELS DAILY

WORLD production of crude petroleum continued its steady increase during 1956, and will be nearing 17,000,000 b/d by the end of this year, having unforeseen developments. Average output for the first nine months of 1956 was 16,776,600 b/d, according to reports gathered by WORLD PETROLEUM. Some figures for the month of September are estimates.

Principal contributors to the increase during the third quarter of 1956 were Canada and Venezuela. Canadian output averaged 466,800 b/d, up 24.7% over the third quarter in 1955 and Venezuela averaged 2,460,500, up 14%. Considerable increase was shown by Brazil, where output nearly tripled in one month, rising to estimated 20,000 b/d during September, and in Colombia, where output rose to 15.9%, about 124,000 b/d the same month. The rise in both countries is attributable to recently-completed pipe line facilities. A rise of 10.7% over 1955's third quarter was shown by Indonesia. British Borneo also rose sharply, up 18.3% compared with 1955, due partly to production from the new Jerudong discovery, which was up to 2,495 b/d in July.

The Western Hemisphere has excellent prospects for future high production levels, due to the fast rise in consumption rates of residual fuel oil, which is efficiently supplied by heavy export crudes such as those from Venezuela. The rise in anticipation of the heating season was greater this year than usual. Suez has created speculation regarding the increased import of Western

(*Continued on page* 163)

PERCENTAGE DISTRIBUTION OF WORLD CRUDE PRODUCTION

Principal Countries	Third Quarter 1956	1955	1954
U.S.A.	42.6	43.6	46.4
Venezuela	14.6	13.9	13.8
USSR	10.9	8.6	8.4
Kuwait	6.9	7.0	7.0
Saudi Arabia	6.1	6.2	6.9
Iraq	4.5	4 3	4.6
Iran	3.3	2.1	0.4
Canada	2.8	2.3	1.9
Mexico	1.5	1.6	1.7
Indonesia	1.5	1.5	1.6
Principal Areas			
North America	46.3	48 ?	50.0
Middle East	22.2	21.3	20.4
South America	16.9	16.3	16.3
Europe & Africa (Inc. USRR & Sat.)	12.1	11.6	10.7
Far East & Oceania	2.5	2.6	2.6
Eastern Hemis.	36.8	35.5	33.7
Western Hemis.	63.2	64 5	66.3

WORLD CRUDE OIL PRODUCTION

(Thousands of Barrels Daily)

	1956 Third Quarter	1956 Second Quarter	1956 First Quarter	1955 Year	1954 Year
United States	7,099.7	7,066.9	7,228.3	6,775.6	6,346.0
Canada	466.8	401.7	455.6	354.7	262.7
Mexico	255.8	252.2	261.3	244.7	226.8
Total N. America	7,822.3	7,720.8	7,945.2	7,375.0	6,835.5
Argentina	82.9	82.1	84.0	83.7	81.3
Bolivia	9.4	8.5	8.5	7.4	4.5
Brazil	12.8	7.1	6.9	5.5	2.6
Chile	10.1	8.8	8.5	6.7	4.8
Colombia	122.5	119.3	115.7	108.8	109.5
Cuba	1.6	1.8	1.5	1.0	0.2
Ecuador	9.8	8.9	9.9	9.7	8.4
Peru	50.5	50.3	48.3	47.2	46.7
Trinidad	80.4	77.2	74.4	68.2	65.0
Venezuela	2,460.5	2,374.3	2,353.7	2,157.2	1,897.2
Total S. America & Caribbean	2,840.5	2,738.3	2,711.4	2,495.4	2,220.2
Total W. Hemisphere	10,662.8	10,459.1	10,656.6	9,870.4	9,055.7
Algeria	0.6	0.7	1.0	1.3	1.6
Austria	63.0	64.4	65.4	68.2	62.0
France	24.6	23.3	21.7	17.0	9.8
French Morocco	1.9	2.2	2.2	2.1	2.4
Germany (West)	69.8	67.1	63.9	60.3	51.8
Italy	12.0	9.8	7.9	3.5	1.5
Netherlands	21.0	20.6	18.5	19.6	17.8
Yugoslavia	3.0	3.0	3.0	3.0	4.2
United Kingdom	1.3	1.4	1.3	1.2	1.2
Total W. Europe & N. Africa (excludes USSR & Sat.)	197.2	192.5	184.9	176.2	152.3
Albania	6.0	6.0	6.0	6.0	3.0
Czechoslovakia	3.0	3.0	3.0	3.0	2.5
Hungary	35.0	35.0	35.0	25.0	14.0
Poland	7.0	7.0	7.0	7.0	4.0
Romania	223.0	223.0	223.0	216.0	150.0
USSR	1,568.0	1,568.0	1,568.0	1,340.0	1,145.0
Total USSR & Sat.	1,842.0	1,842.0	1,842.0	1,597.0	1,318.5
Total Europe & N. Africa (Including USSR & Sat.)	2,039.2	2,034.5	2,026.9	1,773.2	1,470.8
Bahrain	30.0	30.0	30.0	30.2	30.1
Egypt	37.9	37.9	34.7	34.9	37.7
Iran	560.3	565.8	442.4	326.0	56.0
Iraq	758.2	776.1	641.4	665.9	628.7
Israel	0.6	0.6	0.3	0	0
Kuwait	1,163.9	1,199.7	1,141.6	1,092.7	955.8
Neutral Zone	40.0	37.2	31.0	24.2	16.5
Qatar	127.7	126.3	126.1	114.5	104.9
Saudi Arabia	1,029.1	1,086.2	1,007.6	965.0	952.6
Turkey	5.0	5.5	5.9	3.5	1.1
Total Middle East	3,752.7	3,865.3	3,461.0	3,256.9	2,783.4
British Borneo	117.1	117.0	115.1	107.0	98.8
Burma	5.3	4.6	4.4	4.4	3.4
China	19.3	19.3	19.3	19.3	2.0
India	6.2	6.3	6.2	7.1	6.8
Indonesia	257.9	251.2	251.2	234.0	218.1
Japan	5.9	6.9	5.6	7.2	5.9
New Guinea	7.1	7.1	7.1	9.4	10.8
Pakistan	5.7	5.6	5.8	5.7	5.0
Total Asia & Australasia	424.5	418.0	414.7	394.1	350.8
Total E. Hemisphere	6,216.4	6,317.8	5,902.6	5,424.2	4,605.0
World Total	16,897.2	16,776.9	16,559.2	15,294.6	13,660.7

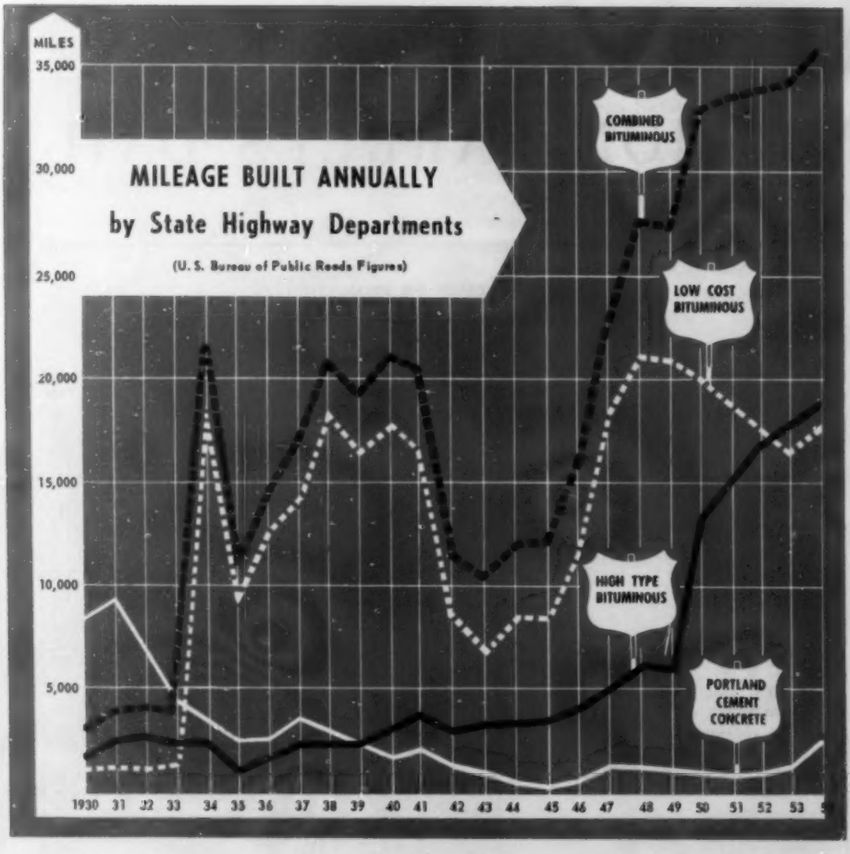


Fig. 1. Mileage built annually by State Highway Departments (U.S. Bureau of Public Roads Figures).

ASPHALT

By Glynn Harvey[1]

THE asphalt segment of the petroleum industry these days is in a position of painful uncertainty.

Business never was better. For the sixth consecutive year the consumption of asphalt paving products is expected to hit a new peak. And with the curtain rising on the largest road-building program in history, the sky is the limit.

Nevertheless, thoughtful persons in the industry are watching the developing highway program with some concern. The long, uphill haul to establish heavy-duty asphalt paving may have been nullified by a stroke of the Presidential pen. All the gains of the past twenty years may be swept away in a torrent of easy-come, easy-go Federal dollars.

"With Uncle Sam putting up ninety cents

[1] News Editor, The Asphalt Institute.

Fig. 2. Typical cross section, Oklahoma's Turner Turnpike.

The great Federal road building program now being undertaken presents an opportunity for expansion of heavy-duty asphalt roads which have been proved cheapest to build and maintain . . . providing the concrete interests do not succeed in selling State and Federal officials on specifying roads of a type which have been decreasing in mileage for fifteen years.

OPPORTUNITY

Fig. 3. Total improved mileage in United States (surface treated or better).

for every state-appropriated dime on the 41,000-mile Interstate System, some state highway departments, released from the strictures of tight budgets, are showing symptoms of "shore-leave philosophy," commented J. E. Buchanan, president of the Asphalt Institute at College Park, Maryland.

"We cannot afford any extravagance or waste in this vast highway program," he added. "Our best engineering skill and ingenuity are needed as never before to provide the roads we need with the funds we will have at our disposal.

"The competition is trying desperately to reverse the tide of engineering and popular opinion which has been swinging steadily to modern asphalt paving. The concrete people are taking advantage of this windfall thinking to concede higher construction costs today, but claiming lower maintenance costs tomorrow based on longer pavement life."

According to the president of The Asphalt Institute this is a specious argument, but some states appear to be succumbing to the siren song of extravagence. And this isn't hard to explain.

"When the states were invited to submit dollar estimates of their highway needs," Buchanan said, "some did the obvious thing; they asked for the moon. The Bureau of Public Roads shrugged and passed along these estimates to Congress. And Congress, in an election year, was not disposed to use the pruning knife."

The result is the states will have more construction money at their disposal than they ever dreamed of. Under these circumstances, the basic economy of asphalt construction loses much of its significance and the tortured reasoning of the competition is receiving more attention than it deserves.

And this is the nature of the asphalt uncertainty: Has modern, turnpike-type asphalt paving had time to entrench itself in engineering esteem and win popular acceptance?

This, for the asphalt industry, may well be regarded as the $100 billion question.

Asphalts for paving use represent 71% of the total asphalt sales in the United States. In terms of tonnage this can be translated into 12,072,873 short tons sold in 1955. Asphalt roofing cements account for another 21% of the market, with about eight percent falling into the "Miscellaneous Industrial Use" category.

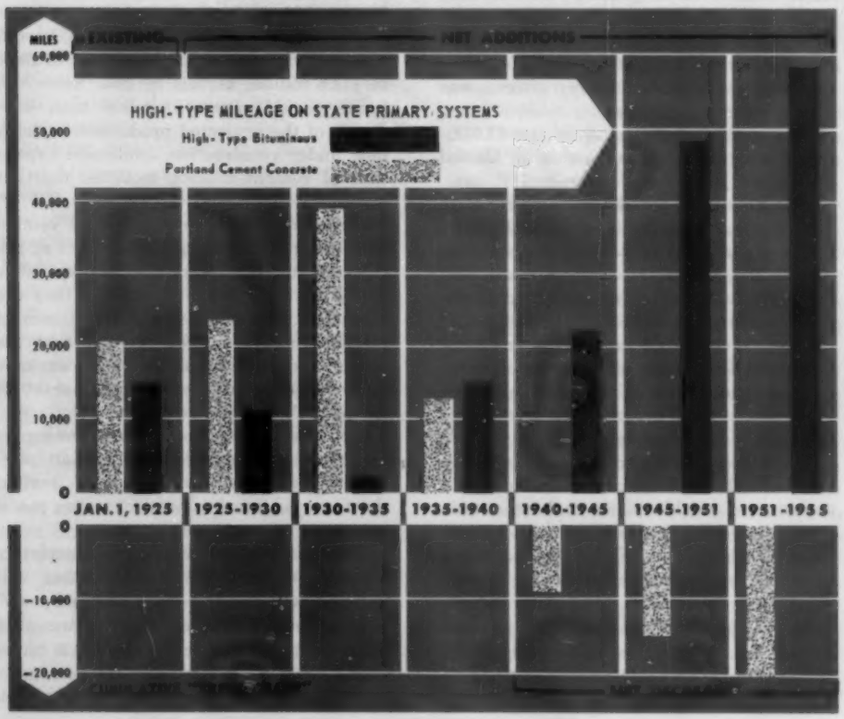
Some idea of the tremendous growth of the asphalt paving market may be gleaned from a brief review of annual tonnage reports from figures compiled by the U.S. Bureau of Mines. From 612,000 short tons in 1919, the consumption of paving asphalts climbed to 7.3 million tons in the next two decades. From 1949 until 1955 this annual figure has climbed steadily at a rate of better than 750,000 tons per year.

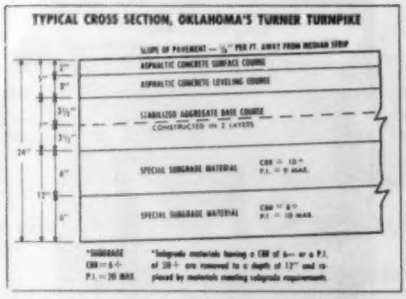
This accelerated rise in sales tonnage since the end of World War II can be attributed to two factors; the rate attrition of the nation's existing highway network and the development of the heavy-duty asphalt pavement suitable for turnpikes and other heavily travelled traffic arteries.

The deplorable state of our highway network is too well known to review here. What has not been properly recognized in the chorus of lamentation has been the heroic role played by asphalt in preserving this system from total and utter collapse. Asphalt surface treatments and overlays, easy on the budget and easy to apply, have kept America's transport wheels turning during a period of desperate highway crisis.

For example, without the saving grace of asphalt, the famed Pennsylvania Turnpike might well have broken down completely in the last few years. Fourteen years ago the first 160 miles of this great concrete highway were opened amid confident predictions they would serve the needs of heavy traffic for a quarter of a century. Since 1954, more than 100 of these original 160 miles have been resurfaced with asphalt as fractured, spalling slabs of concrete be-

Fig. 4. High-type mileage on state primary systems.




TYPICAL CROSS SECTION, OKLAHOMA'S TURNER TURNPIKE
ASPHALTIC CONCRETE SURFACE COURSE
ASPHALTIC CONCRETE LEVELING COURSE
STABILIZED AGGREGATE BASE COURSE
CONSTRUCTED IN 2 LAYERS
SPECIAL SUBGRADE MATERIAL
SPECIAL SUBGRADE MATERIAL

Typical cross section, Oklahoma's Turner Turnpike.

gan to disintegrate under weather and the pounding wheels of modern traffic.

Nor is this phenomenon limited to the world's most publicized turnpike. Since 1945, the existing mileage of concrete pavement on the state highway systems of America has shrunk from a peak of 95,740 miles to about 74,000 miles. In the same period 18,172 miles of new concrete pavement were laid. In other words, during the last decade some 40,000 miles of broken concrete pavement have either been abandoned or—more likely—salvaged with an asphalt overlay.

In the same period the existing mileage of so-called "high-type bituminous" (heavy-duty asphalt) pavement has increased from 65,262 miles to 184,025 miles! These 118,763 miles of modern asphalt paving includes such monuments to advanced asphalt technology as those vastly successful turnpikes built in Maine, New Hampshire, New Jersey and Oklahoma.

Here is the well documented story of a decade of transition. In ten years the highway engineering fraternity moved from almost exclusive recognition of cement concrete for primary highway construction to enthusiastic acceptance of asphalt paving on terms of comparable strength and durability.

Here, also, is the crushing rebuttal to the competition's desperate claim to longer life with lower maintenance. The whole argument is based on bookkeeping legerdemain. The maintenance costs of a concrete pavement rise steadily during its period of decay until, quite abruptly, they vanish completely—along with the pavement. The collapsing pavement is resurfaced with asphalt and, on the books of the Bureau of Public Roads, becomes an asphalt pavement.

Yet, typical of the new tactics of the competition, is this letter mailed to members of the trucking industry in Michigan. "The truckng industry will be a major tax contributor toward Michigan's modernized highway system.

"Will you get the kind of heavy-duty, all-weather road network your industry needs to keep trucks high-balling to so many communities dependent on your services?

"The answer may be 'no' unless you vocally insist now that Michigan's new roads be built of performance-proved concrete.

"Concrete highways will cost you no more —in fact, they actually cost less over the years because they last longer, require less maintenance, and are much safer etc. etc."

The asphalt industry might well take its cue from the competition and address itself directly to another industry which has a proprietary interest in the road program—the parent petroleum industry. Forty percent of the tax money earmarked for this program will be collected by the petroleum industry. Yet, the oil industry ploddingly continues to turn over billions of road-building dollars from tax revenues without "vocally insisting" that the money be spent on construction that will produce more miles of sorely needed road at minimum cost to the gasoline-buying motoring public . . . asphalt-paved super highways.

In 1945 only those intimately concerned with the development of asphalt pavement would have dared predict that the world's busiest toll road could, and would, be built as a flexible asphalt highway. Yet, in 1955, the three-year old New Jersey Turnpike was carrying more than 25 million vehicles. Its cumulative traffic volume had surpassed the much older and widely publicized concrete Pennsylvania Turnpike.

And this year Chief Engineer Charles M. Noble of the New Jersey Turnpike Authority certified the performance record of the turnpike with the statement that "there has been no structural failure to date."

Even more conclusive has been the record of the six-year-old New Hampshire Turnpike. Here is an asphalt pavement which, in six years, has cost only $36.07 per mile for maintenance!

With asphalt-paved turnpikes springing up on every hand at an average construction saving of $50,000 per mile it was only logical that more and more state highway departments, hard pressed for building funds, turned with increasing enthusiasm to modern asphalt for their primary highway networks. In 1955, 93% of all new construction on the state highway systems was keyed to asphalt paving.

This accounted for much of the 12,072,673 tons of paving asphalt sold in the United States last year.

This accounted for the 6.7% increase in sales tonnage over 1954—and for the estimated six percent continuing rise in 1956.

With the arrival of 1957, however, the paving picture will blur, unless common sense engineering economy prevails.

There have been numerous estimates of the probable volume of various construction materials that will be needed to service the massive road program. At best, these are only educated guesses.

Of all these educated guesses, certainly the one with the most impeccable academic background would appear to be the estimate offered by the Department of Commerce. This is the Federal department whose Bureau of Public Roads will oversee the 13-year program.

The Commerce Department statisticians foresee a demand for asphalt paving products starting at 7.15 million tons in the current year and rising to a peak of 10.8 million tons by 1960. This figure is expected to continue through to 1968 when the first slackening in the construction pace is anticipated.

According to this estimate, the 13-year consumption of paving asphalt for new construction will total 127.67 million tons.

Arvin S. Wellborn, chief engineer for The Asphalt Institute, has made a calculated study of the probably future asphalt market in the light of the big road program. He predicts a six percent increase this year over the 1955 figure, followed by a 1957 increase of from 7.5% to 10%, and an additional 10 to 20% increase in 1958 over 1957.

"Naturally," said Wellborn, "the use of asphalt for maintenance also will increase, and I predict that by 1969 the use of asphalt will approach 32 million tons a year." This compares with the 1955 total asphalt sales, for all purpose, of 16,999,224 tons.

The petroleum industry is quite capable of serving this increased demand for asphalts within the framework of existing plant facilities. By greater use of so-called "asphalt" crudes and devoting a larger part of the residual product to asphalt manufacture, Wellborn estimates the industry can double its present output without expanding its present physical plant.

A far different picture is presented by the cement industry.

Some cement shortages have been nagging the construction engineers for the past few years with every likelihood that supply will continue to lag behind demand for the next several months. Surveys show cement production this year will top 350 million barrels. During 1957-58 total capacity output is expected to top 400 million barrels, almost doubling the capacity of the nation's cement mills at the end of World War II.

The highway program, which accounts for one-fifth of the total production volume, is expected to require 74 million barrels this year, rising swiftly to a peak demand of 113.6 million barrels in 1965. Since this figure would represent more than one-fourth of the projected production capacity now under construction, continued expansion of cement-making facilities must be made.

Meanwhile, a large number of cement executives are showing visible signs of becoming nervous about over-expansion. Badly burned once in the 1930's, they are extremely reluctant to risk a bad case of market glut. It is even possible that the cement industry's expansion program may be sharply curtailed somewhere short of the predictable market demand.

But it would be pointless and dangerous to attempt to anticipate the asphalt paving market based on a serious cement shortage. As one business magazine put it recently:

"No amount of expanding will completely eliminate cement shortages, but they will become fewer and less acute within a year."

Consequently, any intelligent appraisal of the gigantic Federal road program in terms of its effect on the asphalt market must start with the assumption that asphalt pav-

ing will be allotted only that portion of the construction pie which the consulting and materials engineers will designate.

Undoubtedly, asphalt paving will continue to dominate the construction picture on the secondary and so-called "feeder" roads that will be built under the expanded program. Virtually all of the roads built with $555 million dollars earmarked by Congress for this construction in the first three years of the program undoubtedly will be paved with asphalt.

Another $832.5 million has been set up for Federal-aid primary highway construction in the same three-year period. Here again there is good reason to believe that asphalt will maintain its favorable ratio of 6-to-1.

Similarly, in view of the tight cement supply, the $462.5 million in Federal aid earmarked for urban highways will require vast tonnages of asphalt. In all three categories, the states will be required to match the Federal funds, dollar for dollar. In other words, this segment of the construction program, through 1959, will pour $1.85 billions into the construction field to be matched by a similar amount from the states—a total of $3.7 billions, of which $3 billions may be devoted to asphalt-paved roads.

This is a fairly solid assurance of an active asphalt market in the first three years of the 13-year program.

But during the same three-year period the Federal government will distribute $4.7 billions to the states for a racing start on construction of the Interstate System. Here, Washington is offering to underwrite 90% of the job and it is here that prudence and economy could be forgotten and tax money dissipated. With pre-construction estimates of need already bloated and Uncle Sam ready to match every dollar with nine more, the heat is off the budget-weary highway commissioners. If they prefer white roads to black roads there's nothing to stop them from indulging themselves in their aesthetic eccentricity.

Nothing, that is, but a thin line of dedicated highway engineers who, in the last decade have proved to their own satisfaction that asphalt provides a superior pavement in every respect. They can provide the balance and the leadership to stall any incipient drift toward extravagance.

The growth in popularity of asphalt pavements since the end of World War II has been phenomenal. The financial and structural success of asphalt-paved turnpikes has convinced many case-hardened skeptics. They even have won from the motoring public a marked measure of approval.

To the perplexity and dismay of the asphalt industry policy-makers in the petroleum industry, concerned about the creeping gasoline tax, have failed to understand the cause and effect relationship at work here. Their one hope of getting the roads they need at minimum costs is offered by their own unique product: asphalt. Yet, few marketing men in the oil industry have had the imagination to grasp the significance of this. Believe it or not, there are petroleum companies that continue to feature concrete-paved roads in their advertising art work!

Shown is a construction company doing resurfacing work on U.S. Route 30 west of Clinton, Iowa. The machine is equipped with extensions for a 12 foot width. The control has been set to build super elevation on the outside rim of the curve, making it more negotiable at today's higher traveling speeds.

In the past year industry members of The Asphalt Institute have armed the Institute with its first advertising appropriation. With this fund the Institute has been waging an aggressive, hard-hitting campaign in the mass circulation and engineering magazines. But the apologists for asphalt paving are starting late and bucking a massive advertising endowment possessed by the opposition which is determined to turn the tide that is flowing strongly against it.

Ultimately, of course, all roads lead to asphalt. Of the 474,000 paved miles on the state highway systems nearly 400,000 miles are surfaced with asphalt, ranging from simple surface treatments to carefully engineered asphaltic concrete pavements. The remaining 74,000 miles of cement concrete will, almost certainly, be overlaid with asphalt one day. That is the usual fate of a deteriorating concrete pavement.

In consequence, any great road-building program carries a built-in guarantee of a solid asphalt market. Win or lose on the first cast of the dice, asphalt always is the ultimate winner. Like death and taxes, asphalt is inevitable.

Meanwhile, however, the Eisenhower road program may pose a threat to the prestige of heavy-duty asphalt paving. If the state highway departments, growing reckless in their new-found wealth, turn back the clock and indulge themselves in another orgy of concrete construction, asphalt's battle to capture the public fancy may have to begin all over again in the 1970's.

Asphalt, of course, could and would recover any lost ground. Time works always for the asphalt cause. But time lost and money squandered in frivolous construction can never be recaptured by the petroleum industry which has a proprietary interest in the road-building program. The oil industry wants and needs more miles of better roads. It needs them swiftly. It needs them at lowest possible cost.

The petroleum industry simply cannot afford to be indifferent in the matter of pavement types. It cannot afford to sit by the side of the road, collecting construction taxes from the passing motorists and asserting a splendid neutralism in the contest for public opinion. Consistency in its opposition to rising gasoline taxes demands all-out support of asphalt economy.

The contest between concrete and asphalt paving has narrowed down to the 41,000-mile Interstate network. Of this total, officials at the Bureau of Public Roads expect about one-third of the mileage to embrace existing routes which either measure up to Interstate requirements now or can be brought up to standard quickly and conveniently. This spells asphalt in the lexicon of the highway engineer.

The remaining 28,000 miles or so will involve relocation of existing routes, meaning new construction. Here is the heart of the dilemma. If asphalt can retain its ratio of popularity with the highway planners and highway builders, Chief Engineer Wellborn's prediction of an eventual annual market of 32 million tons will be conservative indeed.

Despite the scattered reports of defection to concrete, the picture is not entirely black. For example, first contracts let in Pennsylvania and Colorado, two strong "concrete states," called for asphalt construction on roads meeting Interstate System standards. Significantly, both states have experienced early pavement failure on concrete turnpikes.

Further encouraging portents have appeared in North Carolina and Arkansas where state highway engineers have invited The Asphalt Institute to submit pavement designs suitable for Interstate construction.

It would appear from these reports that a decade of aggressive asphalt promotion backstopped by some conspicuous examples of superior asphalt construction has left its imprint on the engineering mind. But the basic question remains unanswered: Is the conversation a firm one, or will there be a general back-sliding into old habits under pressure to engage in a spending, rather than a building, race?

The answer to this question will determine the full impact of the multi-billion dollar Federal highway program on the asphalt market. END

Peter W. Sherwood

PART 1

ACETIC ACID AND ANHYDRIDE

A Case History in Petrochemical Growth

By Peter W. Sherwood

SOME 80% of all acetic acid and anhydride produced in the United States today is derived, directly or indirectly, from petroleum hydrocarbons. This marks a complete turnabout in raw materials position from that encountered as little as 15 years ago.

Today, direct hydrocarbon oxidation processes play a leading part in the production of acetic acid. At two U. S. plants, operated by Celanese Corp. of America and by Warren Petroleum Corp., respectively, butane-propane mixtures are air-oxidized in the vapor-phase to yield a mixture of chemicals, among them acetic acid and acetaldehyde, the acid's prime raw material. At still another installation operated by Celanese Corp. at Pampa, Texas, acetic acid is produced preferentially by liquid-phase oxidation of butane.

Other changes in raw materials position which have brought acetic acid predominantly within the realm of the petrochemical industries relate to the sources of intermediates ethanol, acetaldehyde, methanol and acetone.

Ethyl alcohol may be oxidized directly to acetic acid, and such a process will be considered later in this paper. But for technical reasons, the conversion is effected almost universally in two steps: from ethanol to acetaldehyde, and thence to acetic acid. This oxidation to acetaldehyde is the largest single consumer of industrial alcohol. During the fiscal year ending June 1954, it accounted for 49.5% of all ethanol produced.

Today, an estimated 76.5% of all ethyl alcohol is produced synthetically by two ethylene hydration processes. Here, petrochemical production methods have completely overshadowed fermentation processes which are beset by fluctuations and vagaries in raw materials supply and price.

Acetaldehyde has already been mentioned as the chief source of acetic acid. This synthesis accounts for some 47% of all acetaldehyde produced in the United States.

The last 15 years have seen a marked shift in production methods for acetaldehyde away from the formerly popular hydration of acetylene to the point where nearly 90% of production in the western hemisphere is based on conversion of ethanol and on direct oxidation of light hydrocarbons (notably butane).

Methanol serves to a small extent as intermediate in the synthesis of acetic acid. In this field, too, the petrochemical industries have taken over. During the early 1940's an estimated 80% of all synthesis gas (from which methanol is derived) was obtained by coal and coke gasification. By 1950, natural gas reforming already yielded 60% of the nation's synthesis gas and, at this writing, the share of petroleum hydrocarbons in synthetic methanol manufacture is estimated to be close to 80%.

Acetone is employed, by one British plant, as raw material in the production of acetic anhydride, in a recently commercialized process. It alone of the synthetic intermediates in acetic acid production has always been predominantly a product of the petrochemical industries. But, within this large scope, the last four years have also seen a shift in raw materials base. For, until 1952, only propylene hydration to isopropanol, followed by dehydrogenation, served in the manufacture of synthetic acetone. The picture was changed radically, when supplemental processes made their commercial debut in which acetone was obtained as by-product. First of these was the autoxidation of cumene to phenol and acetone, which is today practiced by at least four commercial plants in the U. S. and Canada alone. In 1955, Shell Chemical Co. started construction of a plant for the simultaneous production of hydrogen peroxide and acetone by the autoxidation of isopropanol. In addition, some acetone is obtained in the previously mentioned direct vapor-phase oxidation of butane.

These new processes threaten to flood the market with inexpensive by-product acetone and may well create a situation where the cracking of acetone to acetic anhydride will become commercially attractive in the United States, as it has already become in England.

Acetic acid, together with its anhydride, is by far the most important of aliphatic acids. In 1954, United States production of acetic acid (synthetic) totaled 442.0 million pounds and acetic anhydride output was 690.6 million pounds.

Principal uses are in the fields of plastics and synthetic fibers production. It has been estimated that 60% of acetic acid output is consumed in the production of cellulose acetate flakes; 30% goes to the production of acetate esters, and the balance is taken up by applications in textile processing and by the production of metallic acetates, rubber chemicals, etc.

Acetic anhydride, the chief derivative of acetic acetate, depends on cellulose acetate for some 95% of its market. Over the years, this relationship has proved a happy one. Cellulose acetate, used primarily in the manufacture of rayon and plastics, has shown a healthy growth curve. In 1953, U. S. output of cellulose acetate was reported at 435 million pounds, having shown a previous rise from 105 million pounds in 1939 to 380 million pounds in 1948. In recent years, however, there have been wide fluctuations: 551 million pounds in 1951, 390 million pounds in 1952 and 364 million pounds in 1954.

To produce one pound of cellulose acetate, about 1.7 pounds acetic anhydride and 2.5 pounds glacial acetic acid must be charged. Actually, only 0.5 pounds of the anhydride is utilized in the course of the process. The recoverable balance (about 3.5 pounds per pound product) is collected as dilute acetic acid which must be concentrated prior to re-use.

Its one major outlet overshadows all other uses for acetic anhydride. But it tells

At Celanese Corporation's Pampa plant, (shown above) butane is oxidized to acetic acid. Photo courtesy Celanese Corporation of America.

by no means the whole story of actual and potential uses for this valuable acetylating agent. Other important chemical uses include the production of the pharmaceuticals acetylsalicyclic acid (aspirin) and cortisone, and of acetanilide, a starting material in the synthesis of some sulfa drugs. Acetylated castor oil finds application in the manufacture of some brake fluids. In addition to its principal use as acetylating agent, acetic anhydride finds some application as dehydrating agent in the manufacture of certain dyestuffs, and as source of higher ketones by reaction with branched-chain olefins.

Production processes for three processes account for the bulk of synthetic production of acetic acid in commercial operation today: Oxidation of hydrocarbons in the vapor phase, oxidation of hydrocarbons in the liquid phase, and oxidation of acetaldehyde. In addition, developmental work of potential value has been carried out in the oxidation of ethyl alcohol and the carbonylation of methanol as routes to acetic acid. Finally, considerable interest attaches to a process which is now being evaluated on a pilot plant scale by Carbide and Carbon Chemicals Corp. In this scheme, peracetic acid serves as oxidizing agent in the production of epoxides, yielding acetic acid as by-product.

Hydrocarbon Oxidation Processes. Butane (and some propane) is oxidized by two fundamentally different processes. Oxidation in the vapor-phase (using either air or purified oxygen) yields a wide mixture of lower alcohols, aldehydes, and aliphatic acids plus smaller amounts of ketones and other oxygenated compounds. Liquid-phase oxidation also leads to a complex product mixture but, in it, acetic acid predominates.

Non-catalytic oxidation in the vapor phase is the "shot-gun" method employed at all but one operating commercial plants for partial oxidation of lower paraffins. Obviously, the reaction is susceptible to over-oxidation and side reactions and close control must be exerted over reaction variables. Controlling are inlet gas composition and method of mixing the reactants, total system pressure and partial pressure of reactants, residence time and, of course, operating temperature.

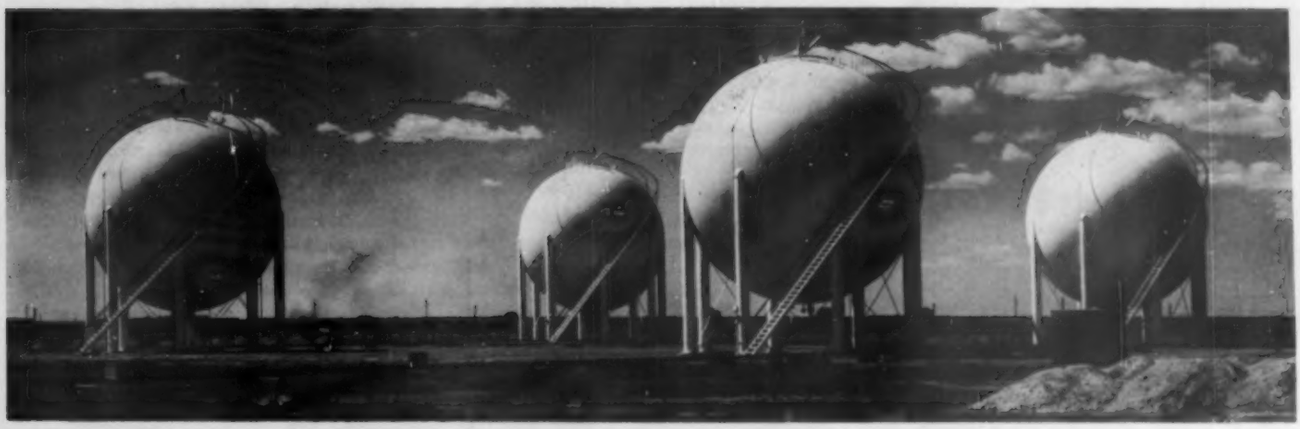
Effect of reactants concentration on individual product formation has been reported by Powers (1) for the oxidation of propane at 275°C. See Table 1.

Low temperature is most favorable for high yield of oxygenated chemicals. But for reasons of reaction rate, a lower practical limit is set in the non-catalytic process. Commercial processes are operated in the range 325-375°C (maximum).

Reaction time is controlled to a minimum of 1-1.5 seconds. Quon (2) has shown that further increase in reaction time is without effect on useful product formation, but results in increased conversion of butane to carbon oxides.

These general principles are embodied in industrial application of vapor-phase paraffin oxidation. Air (in the Celanese process) or oxygen (in the process of Warren Petroleum Corp.) together with diluent, and feed hydrocarbon are preheated separately to a mix temperature of 300-325°C, at which

Butane storage tanks at the Pampa, Texas acetic plant of Celanese Corporation of America. Photo courtesy of Celanese Corporation of America.



Section of Warren Petroleum Corp. petrochemical plant in which chemicals are recovered from the oxidation system. Photo by Robert C. Pattison for Warren Petroleum Corp.

level the combined gases enter the converter. Either steam or recycle hydrocarbon (or both) may serve as "diluent," i.e. to keep oxygen concentration at its optimum of 4-5%.

Immediately following the converter, a water spray quenches the effluent gases to not more than 180°C. After further cooling and condensation, the products are ready for separation. It is obvious that the complexity of the product mixture imposes a formidable purification problem which has been solved successfully by schemes relying on extractive and azeotropic distillation methods as key steps (3).

Liquid-Phase Oxidation of Butane. Good yield of acetic acid, together with lesser amounts of other oxygenated products, is possible by low-temperature catalytic air oxidation of light paraffins in the liquid phase. Such operation must be carried out at elevated pressure and in the presence of a solvent. Acetic acid, itself the main product of the reaction, is a suitable solvent for this purpose.

Loder (4) indicates that the reaction is most suitably carried out at 125-200°C. His patent covers numerous catalysts, of which cobalt acetate appears particularly active. As is frequently the case in liquid-phase oxidation reaction, there is an incubation period which may be essentially eliminated by addition of a peroxide as initiator. Since the reaction proceeds entirely in the liquid phase, conversion rate is increased by boosting the pressure for higher solubility of the hydrocarbon.

Mitchell and Luke (5) used 1,300 parts glacial acetic acid (as solvent) containing 0.3 wt. % chromium acetate. Liquid n-butane was introduced at 3.5 parts by weight per minute and air was fed into the system through a sparger at 16.35 wt. parts per minute. Operating temperature was 165-170°C, and pressure was 815 psia.

Overhead vapors were condensed and settled into two phases. The hydrocarbon layer is water-washed and the washings are combined with the aqueous product phase for subsequent isolation of the water-soluble oxygenated products. The washed hydrocarbon is recycled to the process. This approach gave the following yields from 100 parts butane: 79.2 wt. parts acetic acid, 12.6 parts methyl acetate, 7.2 parts ethyl acetate, 1.9 parts alcohols, and 6.6 parts methyl ethyl ketone.

Larger yield of acetic acid can be obtained at the expense of other products by regarding the hydrocarbon phase from the reactor overhead condensate *without* subjecting it to water extraction. In that event, 100 pounds butane will yield at otherwise comparable conditions: 103.7 pounds acetic acid, 9.3 pounds mixed esters, 4.5 pounds methyl ethyl ketone and 1.0 lb. alcohols.

Partial Oxidation of Acetaldehyde. Volume-wise, this process is the most important route to acetic acid. The reaction mechanism involves the intermediate formation of paracetic acid which reacts with another mole of acetaldehyde to yield acetic acid:

$$CH_3CHO + O_2 \longrightarrow CH_3CO_3H \xrightarrow{CH_3CHO} 2CH_3COOH \quad (1)$$

Both air and purified oxygen serve as oxidizing agent. Of late, the trend has been toward the use of oxygen because the smaller volume of tail gases permits satisfactory product recovery at lower system pressure and without the need to introduce mechanical refrigeration.

The reaction is catalyzed by peracetic acid (autoxidation) and by heavy metal salts, notably those of manganese and iron. In actual practice, only manganese acetate is used because the non-catalytic reaction leads to hazardous build-up of explosive peracetic acid, as does iron catalysis which promotes peracetic acid formation (at low concentrations) more effectively than it accelerates the decomposition reaction of the per-acid.

Manganese acetate, on the other hand, favors not only the oxidation of acetaldehyde; but also causes breakdown of peracetic acid with sufficient rapidity to keep its concentration within safe limits. To further minimize the explosion hazard, it is essential that acetic acid be present in the system at all times. This poses no problem in the continuous acetic acid processes which are universally practiced today.

Jockusch (6) finds that the action of manganese acetate may be explained by three main considerations:

1. The first step in the reaction—catalytic or non-catalytic—is the formation of peracetic acid from acetaldehyde and oxygen. This step is not influenced by the catalyst.

2. In the absence of catalysts, peroxide initiates a chain reaction between aldehyde and oxygen. Manganous salts are preferentially oxidized by peracetic acid to the manganic form thereby breaking the chain mechanism of aldehyde oxidation. This period of manganous salt oxidation causes an incubation period for the reaction.

3. Manganic salt also decomposes peracetic acid, but does so by transferring oxygen to the aldehyde. Here, the manganese salt may be overoxidized to a slowly acting form, if unduly low catalyst concentration

TABLE 1

Effect of Reactants Concentration on Product Formation[1]

Propane-to-air ratio	1:20	1:15	1:3.6	1:1.25	1:0.05
Product	Yield, percent of carbon from propane oxidized				
Total aldehydes	12.5	8.8	12.0	16.1	16.7
Normal alcohols	17.3	25.5	23.0	33.1	34.5
Isopropyl alcohol	2.7	6.9	5.2	5.2	14.4
Acetone	1.2	1.4	1.3	0.3	7.4
Acids	13.9	13.4	15.2	8.9	12.5
Total condensable products	47.6	56.0	56.7	63.6	85.5

[1]Pressure influences the yield of useful products. Thus, Quon (2) obtained practically no reaction below 50 psia. Optimum performance was obtained at 50 psia. At higher pressure, increased formation of carbon oxides detracted from useful yield.

(say 0.01 to 0.03 wt.%) is chosen. In commercial practice, catalyst is fed with the incoming liquid acetaldehyde stream in about 0.13 weight percent strength.

The oxidation of acetaldehyde is highly exothermic (122,000 btu/lb.-mole), and suitable cooling means must be provided to hold operating temperature between 50 and 70°C. Oxygen absorption rate is highest at acid strengths between 25 and 80%. Conversion is therefore not taken on a once-through basis but some 20-30% of acetaldehyde is left unconverted, separated from the product stream and recycled to the reaction stage.

Aluminum is the usual material of construction in contact with the reaction phase. The presence of even small amounts of iron is objectionable because of its tendency to favor the build-up of explosive peracetic acid.

At one commercial acetic acid plant, the reactors are vertical aluminum-clad towers, each consisting of five 6-foot sections. Each section is provided with internal aluminum cooling coils and is separated from the adjacent parts of the tower by means of perforated aluminum plates (7).

Acetaldehyde and catalyst are fed to the bottom of the tower. At the entrance to each of the lower four tower sections, the reaction phase is joined by a stream of oxygen.

An enlarged section at the top of the reaction tower permits separation of the product from the tail gas which is passed through a condenser and then vented. The liquid reactor make is worked up in two fractionating columns. In the first of these, light-boilers (acetaldehyde, methanol, formaldehyde, etc.) are taken overhead and are taken to a purification section.

The bottoms from the primary column are fed to an acetic acid finishing column in which the product is taken overhead in 96% strength, leaving paradehyde, ethylidene diacetate, etc. in the bottoms.

This design is illustrative of commercial techniques, but interest extends also to other reactor units in which cooling is provided by pumping the reaction phase through external coolers.

The system pressure is entirely dependent on whether air or oxygen is employed. With oxygen a pressure of 45 psig is in order, and satisfactory aldehyde and acid recovery from the reactor tail gases can be achieved simply by means of a water-cooled condenser. (Operation at pressure as low as 5 psig has been reported). A portion of the cooled tail gas is recycled to the reactor, permitting an operation to a 50% oxygen content in the tail gas (8).

Installations using air must operate without tail gas recycle, and call for a system pressure of 100-150 psig. To attain satisfactory aldehyde and acid recovery in such a system, requires that the tail gases be cooled and then water-scrubbed (7). The complications in such a system have been responsible for the wide adoption of oxygen as oxidizing medium for acetaldehyde.

In the oxidation of acetaldehyde to acetic acid by oxygen or by air, an ultimate yield of 95-96% of theory is obtainned.

Direct Oxidation of Ethyl Alcohol. The single-step oxidation of ethyl alcohol to acetic acid, i.e. without separating intermediate acetaldehyde, has been variously investigated and patented. The process has not, however, attained commercial interest, and will therefore be considered only briefly.

There are several obstacles to the direct conversion of alcohol to acetic acid. First of all is the question of temperature control which, with an exothermic reaction heat of 211,000 Btu/lb.-mole imposes a severe engineering problem.

There are other difficulties. For the direct oxidation of alcohols, liquid-phase catalysis is found most suitable and here, the formation of water causes a dilution problem. Furthermore, in all attempts to date, overall yield of acetic acid is less favorable than in the two-step process via acetaldehyde.

Actually, the commercial two-step process is relatively straight-forward and, because of the physical properties of the chemicals involved, causes a minimum of separation problems. There is therefore only a small margin of economic incentive in developing single-stage oxidation of ethanol to acetic acid and such processes to date have not even equaled the *economic* performance realizable in the two-step method.

Almost the entire periodic table has been covered in catalyst patents for the single-stage oxidation of ethanol. Among vapor-phase catalysts might be mentioned various compounds of vanadium, zinc oxide, silver, copper, nickel, cobalt and iron. These vapor-phase processes are carried out above 300-350°C and show substantial loss due to decomposition and degradation reactions.

Liquid-phase catalysis has been proposed, in which the catalyst is concentrated acetic acid containing dissolved metal salts, among them the rare earths (Hull (9) claims 94-95% yield in oxidizing ethanol to acetic acid in 100% acetic acid containing 2.5% cerium or 1.5% neodymium). Also mentioned, though with less apparent effectiveness, is the use of vanadium or bismuth salts dissolved in acetic acid.

Of interest is a process, due to Hull (10) in which a mixture of 30 mole % ethanol and 70% acetaldehyde is oxidized continuously to acetic acid, in the presence of a liquid-phase catalyst which consists of 85% acetic acid containing 6% cobalt acetate.

In the course of processing, the catalyst would be diluted by water of formation as well as by alcohol, by-product ethyl acetate, etc.

Such dilution leads to rapid loss in catalyst activity and Hull, therefore, continuously keeps the strength of acetic acid at 85% by introducing glacial acetic acid. The problem becomes more acute as the ethanol: acetaldehyde ratio in the feed is raised, and the aforementioned ratio of 30:70 is close to the useful limit. At this ratio, and without adjustment in catalyst strength, he initial ultimate yield of acid was 88% and per-pass conversion was 25%. After two hours, the catalyst had lost practically all oxidizing activity.

At the same conditions, but with continuous adjustment of catalyst acid strength to 85%, very long activity could be maintained. Yield, on alcohol was 92-95% and conversion was 50-70% per pass. However, 1.5-2.0 lbs. glacial acetic acid has to be returned per pound acid produced, so that a severe load is placed on the unit's distillation facilities (final acetic acid drying involves use of azeotropic methods).

Operating temperature is between 60 and 100° C. Air is the oxidizing medium. Operating pressure need merely be atmospheric but there is a significant increase in throughput as the pressure is reasonably raised (say, to about 50 psig.) A further advantage of operation at elevated pressure is the fact that it permits readier recovery of contained organic chemicals from tails gases without recourse to refrigeration and with smaller condensers.

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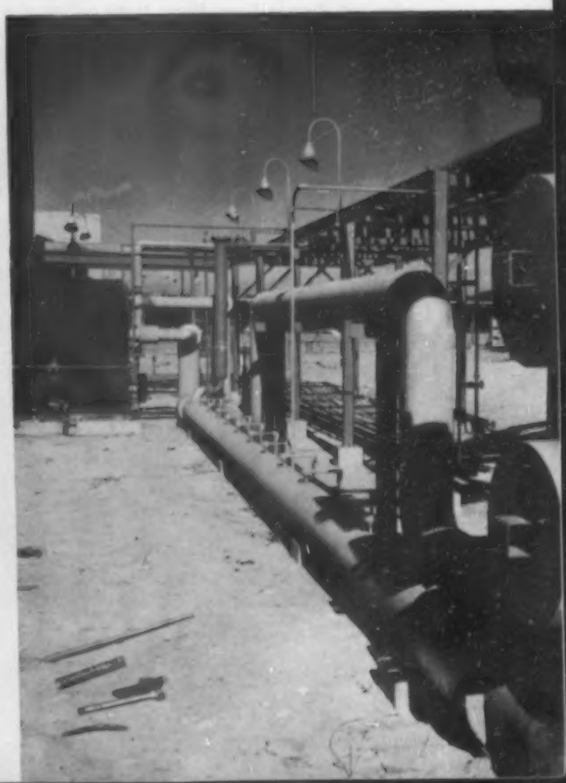
END

(Part II of this report will be published in an early issue. Editor)

Warren Petroleum Corp. unit in which oxygen and hydrocarbons are combined for the production of aldehydes; mainly acetaldehyde, formaldehyde and menthanol. Photo courtesy Warren Petroleum Corp.



Westcoast Gas Line Construction Nearly Half Completed

HALF-WAY mark in the construction of the Westcoast Transmission Co. natural gas line from British Columbia gas fields to the U.S. Border will be reached before the end of December. Proceeding on schedule the line should be ready for operation in the fall of 1957.

The 88-mile line passing through rugged territory will cost $153 million exclusive of the gathering system in the Fort St. John area. It is scheduled to deliver 400 million cubic feet per day at the outset and rise to 500 mmcf per day by 1960. Ultimate capacity is 660 mmcf per day. Four compressor stations will be used at the start, nine ultimately.

The main line consists of 650 miles of 30-inch, and 38 miles of 24-inch pipe. The line starts at Taylor Flats, nine miles south of Fort St. John, and runs in a southerly direction to Huntingdon, British Columbia, on the international boundary, across from the village of Sumas, Washington.

For the most part the line runs through thinly populated country. The northern terminus is on the rim of the Peace River grain-growing belt. The route then swings south through the Pine Pass of the Rocky Mountains, and then penetrates the forested lakelands of the Prince George and Quesnel districts. In the neighborhood of Williams Lake the line starts to traverse the Caribou country, rolling parklands, devoted to cattle ranching; thence to Savona and Merritt, semi-arid livestock producing areas. From a point south of the cow-town of Merritt, the line turns westward into the higher levels of the Coquihalla Canyon, where, in the Cascade range, it reaches its highest altitude, 4,700 feet. From that point it drops down toward the village of Hope, and the sea-level farm region of the Fraser River Valley.

Work started in January, 1955, when Westcoast appointed Canadian Bechtel Ltd., Vancouver, B.C., as agent and managers of engineering and construction. Ford, Bacon and Davis is acting as a consultant to Westcoast and are doing the detailed design of the compressor stations.

Several location parties were placed in the field; and at the same time aerial reconnaissance was undertaken. Surveys showed 80% of the terrain as forested; that there would be seven major river crossings; and about 70 streams and creeks, rated as minor crossings; 41 railway crossings; 66 cased highway crossings. In one 96-mile section of the Prince George-Dawson Creek highway there are 19 cased crossings.

The lands department contacted 1,150 landowners with holdings varying in size from town lots to market gardens, and cattle ranches up to 30,000 acres. Much of the territory is sparsely populated and undeveloped. This accounts for the fact that the route runs through 491 miles of Provincial and Federal Crown lands. There are, however, 159 miles of privately owned lands made up of 1,400 parcels. In addition the line touches 15 Indian reserves for a total of 27 miles. In acquiring easements on aboriginal lands it is necessary to proceed through the government department of Indian Affairs as well as meetings with chiefs and councillors of Indian bands.

Water, as well as overburden, is an important factor on this line. Planning and construction have to deal with high-water table and drainage canals in the lowlands of the Fraser Valley; mountain streams in the Cascades; myriad pools and pot-holes in the so-called dry-belt; marshes on the fringes of the forests of the interior.

Since 80% of the line is forested to some extent, it was necessary to engage the services of independent, registered timber cruising companies to appraise the trees on the properties. Arrangements were made individually with the owners as to the sale

Dutton-Williams Brothers has the contract for 110 miles from Taylor Flats to a point near Parsnip River. Shown is the construction camp in Pine Pass, B.C.

Gunniting pipe for Peace River Crossing, Dawson Creek. B.C.
(All photos used in this article courtesy of Canadian Bechtel Ltd.).

and disposal of the wood. No merchantable timber was destroyed.

Orders were placed for the 650 miles of 30-inch steel pipe: Suppliers: South Durham Iron and Steel Co., Ltd., Stockton-on-Tees, England; A. O. Smith, Milwaukee; U. S. Steel Export Co., Consolidated Western Steel Division, Geneva, Utah; Colorado Fuel and Iron Corp., Claymont, Del., Republic Steel Corp., Alabama City, Ala.

Of these orders, the purchase of 90,000 tons valued at $15 million placed in England, was the largest single order of its kind ever placed by a Canadian firm with the British corporation, and marked a new milestone in inter-Empire trade.

The first ship carrying 1,300 tons of pipe of .375-inch wall thickness in 40-foot lengths arrived in Vancouver, B.C., Feb. 15, 1956. Up to Sept. 21 a total of 23 ships had delivered 34,500 tons of pipe.

Pipe was loaded directly from ship to flat cars on the pier spur. The cars were then switched to barges of the Pacific Great Eastern Railway for the 40-mile sea journey to Squamish, southern connecting point of the P.G.E. From there the pipe was moved by special train to Prince George, 395 miles to the north. From that terminus it was trucked on the last lap of 225 miles to stock-piling points along the line.

Construction is divided into five schedules.

Morrison-Knudsen Co. of Canada Ltd., has the contract for 155 miles of gathering lines. They vary from 10-inch to 24-inch, and connect the gas fields of Alberta and British Columbia with the treating plant at Taylor Flats.

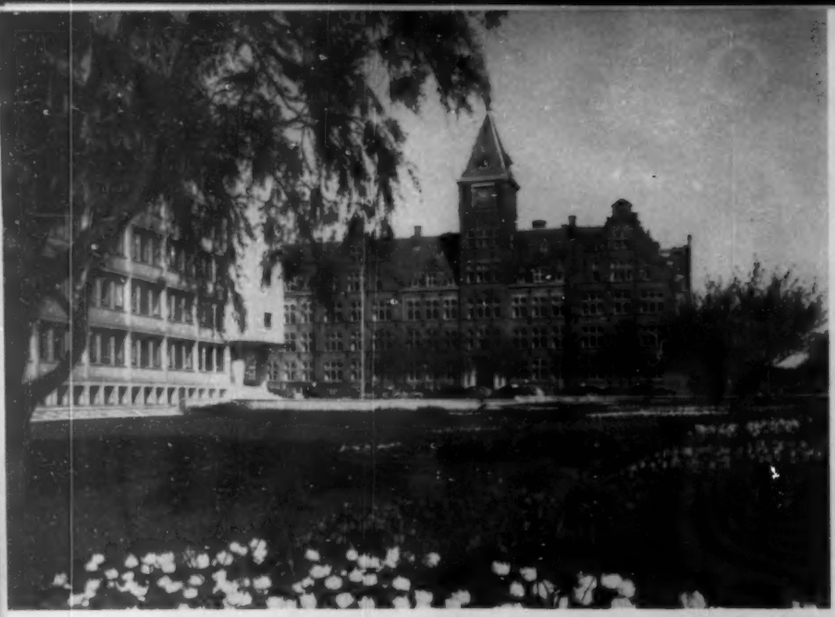
There are four schedules for the main line:

Dutton-Williams Brothers have the contract for 110 miles from Taylor Flats to a point near the Parsnip River. Bechtel construction division has the responsibility for 210 miles from the Parsnip to a point just north of Williams Lake. Conyes Construction Corp. has 210 miles from a point north of Williams Lake to a point near Merritt. Mannix Ltd. has 110 miles from Merritt to Huntingdon.

Construction started in the autumn of 1955 on the southern end of the line when Mannix moved a complete spread into the Fraser Valley near Huntingdon. They welded seven miles of pipe before winter forced a partial shutdown. Clearing, however, was carried out during the winter. Materials were stock-piled. Several river crossings were made during low water. At the peak of summer operations approximately 1,900 men were employed on the project. At the close of September work was in progress on three compressor stations and major river crossings. Operation of the pipe plant was suspended in August after 118 miles of 40-foot pipe had been welded in 80-foot joints. Line testing of 125 miles of pipe was begun. Pipe on hand amounted to 460 miles; right-of-way cleared, 563 miles; right-of-way graded, 401 miles; trench excavated, 321 miles; pipe welded, 295 miles; pipe lowered in, 263 miles; clean-up, 120 miles. END

View of Westcoast Transmission Company's line. Lowing in Cottonwood Canyon Region, near Quesnel, B.C.

Switching Westcoast Transmission pipe at Williams Lake, Pacific Great Eastern Ry., B.C.



Head office of N. V. De Bataafsche Petroleum Maatschappij (Royal Dutch/Shell Group) which is also the registered office of the N. V. Koninklijke Nederlandsche Petroleum Maatschappij.

Dutch operators hope development of the newly-discovered West field in Holland will replace declining production at Schoonebeck. Several exploratory wells are underway, with more expected when additional concessions are granted. The active refining industry is scheduled to receive additions to catalytic cracking and platforming capacity.

NEW DUTCH

THE N.V. Nederlandse Aardolie Maatschappij was formed in 1947 as a joint venture of the Royal Dutch/Shell Group and the Standard Oil Co. (N.J.), each company having a 50% interest. The management of N.A.M. is in the hands of the Royal Dutch/Shell Group at The Hague and the head office, responsible for day-to-day administration, is at Oldenzeal near the field at Schoonebeck.

At the present time there are 275 producing wells on the Schoonebeck field, producing at a total rate of 2,900 cub. meters per day (18,240 b/d), but production is gradually declining. The drilling program calls for five more wells to be drilled. The estimated maximum life of the field is 70 years.

Apart from its value as a producing field, this field is being used as a training school for new company entrants and is also for research on reservoir problems.

One of these problems concerns the disposal of salt water which is produced in the field along with the oil, since it cannot be dispersed over the surrounding agricultural land. In part of the field it can be readily absorbed, but requires prior treatment before absorption. Primarily, this salt water contains colloidal iron, which in the presence of air is oxidized to a finely divided iron oxide, this if returned to the formation, will adversely affect the porosity; and secondly if exposed to sunlight algae develop very rapidly and also cause trouble. A method of treatment has therefore been developed which avoids exposure to oxygen and light and allows the salt water to be returned in the same condition in which it was extracted.

Another problem which is being closely studied in this field is the extraction percentage of the crude oil from the porous rocks. Under present conditions only about 30% of the oil content is extracted leaving 70% in site. Methods of increasing this extraction rate are being studied conjointly by the field staff and the staff of the Royal Dutch/Shell Laboratory at Amsterdam.

These studies are connected with the flow of oil gas and water through porous subterranean strata. Studies are being made on the effect of heat on this problem, including the injection of hot water under high pressure, and also on the effect of partial combustion of the oil, with a view to increasing the potential recovery of oil.

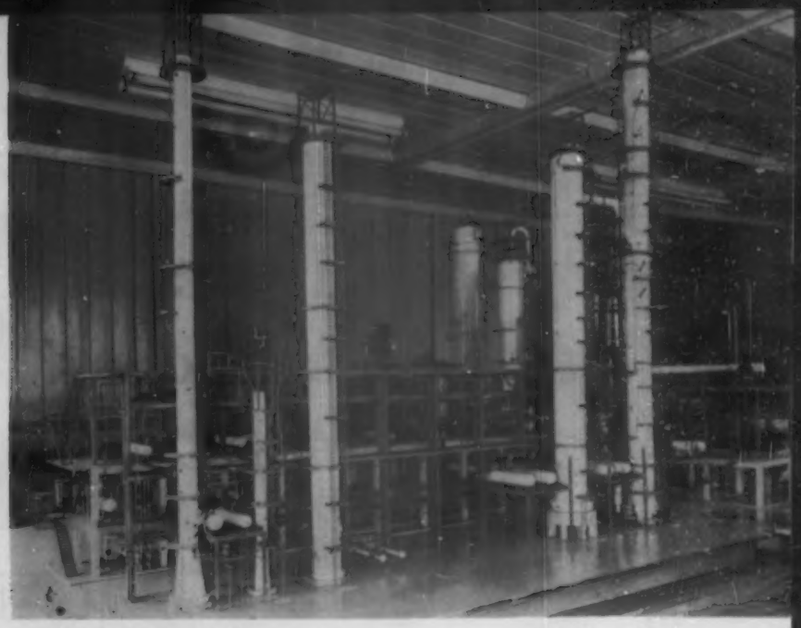
N.A.M. is hoping to balance the declining production of Schoonebeck field by development of the new West field located in the Rotterdam and Hague districts, only about 10 miles from the Pernis Refinery. The discovery well is located near Ijsselmonde near Rotterdam on the South bank of the Maas, and is at present producing at a rate of 20 tons per day (about 140 b/d). Economic production in this field has also been obtained in wells drilled at Berkel, Delft, de Lier, Pynacher, Rijswijk and at Wassenaar, this latter being the first flowing well to be drilled in Holland and the latest to be brought in.

The production from West Holland is at present running at about 400 tons per day (about 2,800 b/d) and is gradually increasing. Further "wildcats" are to be drilled at Monster, Ridderkirk and Zoetermur in de Lier, where development drilling is scheduled to go to 9,900 feet. Present wells are producing at 3,960-4,290 feet.

It was intended to use a turbo-drill in an exploration well near Schoonebeck, for drilling in hard formations expected to be

An exploratory well by N. V. Nederlandse Aardolie Maatschappij, a joint enterprise of Royal Dutch/Shell Group and Standard Oil Co., N.J.

OIL HOPES



Additions to capacity at Pernis are being built in accordance with a new system—new to European refineries, at least—of building refineries with the aid of an exact scale model. Shown is an exact model of the gas treating plant III, scale 1:50.

met at about 4,000 feet. The formation met, however, was not of the type expected, so rotary drilling was continued and in mid-September was over 6,500 feet. Later, it is intended to utilize the turbo-drill in densely populated areas for directional drilling, there being indications that oil may be present in these areas.

The flowing well at Wassenaar is located in a very promising sand and the oil is of high quality and sulfur free, specific gravity 0.905, as is the oil from Schoonebeck field.

West Holland was producing 0.3% of Holland's total crude production in 1953, which rose to 8% for 1955. In the first half of 1956 the percentage was 11 and the present rate is 13%. The maximum possible production from this field is not known, nor can it be predicted, as certain concessions are not yet granted and it will be at least a year before all applications for concessions have been dealt with, and concessions freed for exploration.

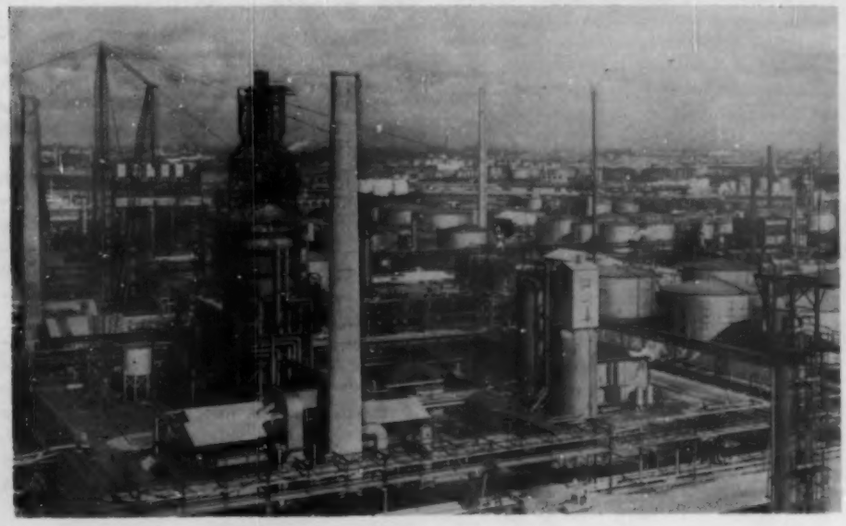
In addition to its crude oil production N.A.M. has also developed gas fields to the north of Schoonebeck in the neighborhoods of Assen and Enschede. The gas is of high quality and is available in such quantity that N.A.M. has offered to supply the government with 14 million cubic feet of natural gas for the next twenty years, this being one-fourth of the estimated requirement of the state. In addition, refinery gas from the Pernis refinery is supplied to Rotterdam and district, the remaining state requirements being from coal gas for coal mined in the south east of Holland.

The refinery at Pernis is now handling about 12 million tons of crude oil per year (24,000 b/d) and is fully integrated, producing all types of petroleum products and also petro-chemicals. In all 20 types of crude oil are handled, seven types from indigenous crudes and 13 from imported crudes. The Dutch crude refined in 1955 was 1.1 million tons (about 22,000 b/d).

A new 35,000 b/d catalytic cracker is being built and is scheduled to go on stream in November 1956. In addition to the catalytic cracker, a Platforming unit is being erected and in line with this a hydrodesulfurisation plant, based on Shell's "Trickle" process.

END

Part of the premises of Shell's Pernis plant and installations. In the foreground can be seen catalytic cracking plant No. 1 (Photo courtesy of N.A.M.).

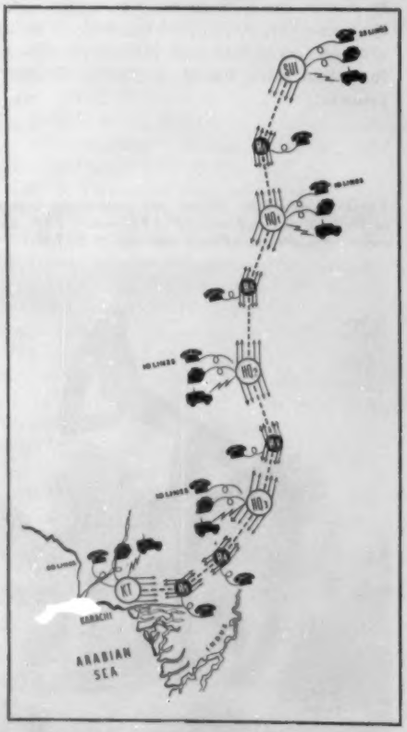


These pumps near Drente are commonly known in Holland as "Ja-Knikkers" (Yes-men). They are electrically driven. (Photo courtesy of N.A.M.)

VHF Radio installed on SUI GAS LINE

Problems of communication and control in inaccessible stretches of the Sui gas pipe line in Pakistan were solved by use of very high frequency radio facilities. They proved their worth in immediately isolating two breaks detected in the line during initial tests and have since provided reliable communication, even during the monsoon rain when much of the pipe line route was flooded.

Sui Karachi gas pipe line. Shown are the radio tower and office building at sunset.



Pictorial representation of VHF telephone and teleprinter system on Sui gas line.

When the planning of the pipeline to carry natural gas from the Sui gas field in Baluchistan to Karachi, a distance of over 300 miles, was begun, it was realized that a system of communication would be necessary along this line; and that this system, to be successful, would have overcome various natural difficulties and provide a 100% satisfactory service.

The pipeline traverses desert country[1] and irrigated agricultural land, with few towns located between the extreme ends of the line. No service could be expected from the national telephone network.

Three different systems of communication were considered, i.e. overhead telephone lines, buried telephone lines and a VHF (very high frequency) radio system. In the case of an overhead telephone line, the cost of copper wire, poles, etc., is high, as is the construction cost. The telephone line would have to follow the route of the pipeline, through areas of shifting sand dunes, and in the irrigated areas over many unabridged canal crossings. It would also be subject to seasonal flooding by the river Indus, and also in certain tribal areas, breakdowns due to theft of copper wire and to breakage of insulators, which provide good targets for rifle practice.

The cost of the installation of buried telephone lines would be much greater than the cost of overhead lines, sufficient to wipe out any advantage gained by reducing loss of wire by theft or breaking of insulators. Therefore, both these schemes were rejected in favor of a VHF radio system.

The Sui Gas Transmission Co., Ltd. therefore called for competitive tenders for the installation of a VHF radio system and the contract was awarded to Pye Ltd., Cambridge, England.

This company in collaboration with Ericson Telephones Ltd., planned the complete system which was installed May-November 1955. Service was begun along the whole line in mid-August 1955, coinciding with completion of the line.

The facilities provided by the system are: telephone and teleprinter services between Karachi, Sui and three intermediate headquarter stations; telephone service between repeater and headquarter stations; and mobile 2-way radio service for all vehicles working on the pipeline.

The pipeline distance from Sui to Karachi is 350 miles, and this is split by gate valves into sections of about 30 miles. Radio repeater stations were arranged to coincide with these gate valves, and three of these, where booster pumps will ultimately be added to the pipeline, are designated as intermediated headquarters stations.

[1] *Articles describing the construction of the Sui Gas Line appeared in World Petroleum for October, 1954, May, 1955 and August, 1955. Editor*

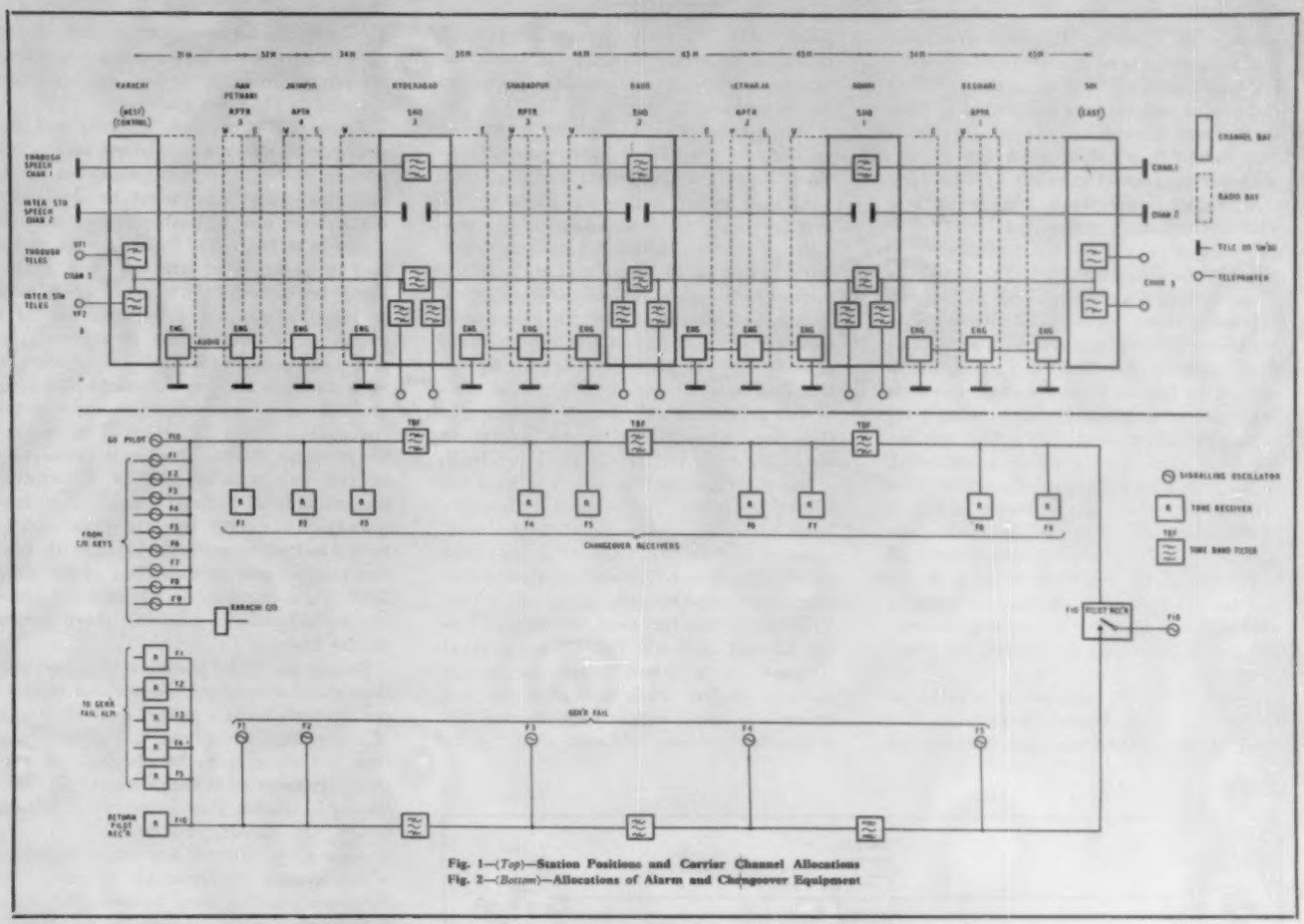


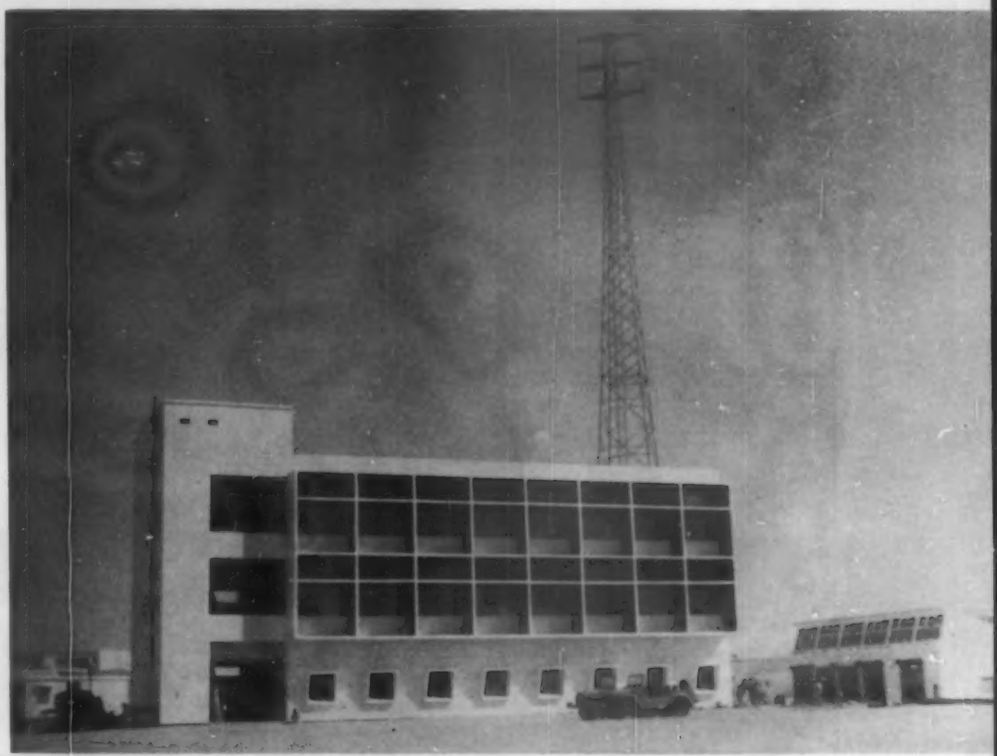
Fig. 1—(*Top*)—Station Positions and Carrier Channel Allocations
Fig. 2—(*Bottom*)—Allocations of Alarm and Changeover Equipment

Figure 1—(Top)—Station Positions and Carrier Channel Allocations. (Bottom)—Allocations of Alarm and Changeover Equipment.

Gas control staff for the whole line is located at Karachi and pipeline pressures are reported to them at four hour intervals from Sui and to eight intermediate stations. On the basis of these reports the flow of gas from the producing wells at Sui into the pipeline is regulated. In the event of a break in the pipeline occurring it is essential to close the gate valves either side of the break in order to minimize the loss of gas so the continuation of supply during any emergency is dependent on efficient control and prompt action. There is also a regular communications traffic between stations on engineering and administration, especially since normal postal services are not available between pipeline stations.

When the pipeline is in normal operation much of the communications traffic is routine, requiring permanent record rather than immediate action. To handle this type of traffic a teleprinter service between Karachi, Sui and the headquarter stations was called for. A big advantage of this arrangement is that it cuts out language difficulties in passing messages.

Vehicles engaged in patrolling and maintenance also required two-way radio communication with the headquarters and terminal stations, and such mobile calls had to be capable of connection with the main telephone system for transmission to any other station on the pipeline. There are a



Main administrative building, Karachi terminal. Radio tower is alongside.

number of unattended gate valves, and during special operations (for example during initial filing and testing of the pipeline) radio-equipped vehicles are posted to these valves, and through the nearest headquarters station they are in immediate contact with the gas control engineer at Karachi.

Presented with these requirements a VHF multichannel system was designed in detail by Pye and Ericsson engineers to give the facilities specified. The backbone of the system is a chain of VHF multichannel radio links, Karachi-R5, R5-R4, R4-Hq.3, etc. This radio system has a modulation baseband 300-30,000 c/s, and this is utilized to transmit three carrier channels plus one audio circuit. For channeling purposes the system is split into four sections KT-Hq.3, Hq.3-Hq.2, Hq.2-Hq.1, Hq.1-Sui; all four sections are essentially similar. The allocation of channels, is shown in Fig. I.

The audio circuit in each section is designed as a party line interconnecting all stations—KT, R5, R4, Hq.3, in the first section for example. This channel is normally used only for repeater station communication i.e. reporting of gate valve gas pressures, etc.

The first carrier channel is utilized as a direct through channel, Karachi to Sui; this channel is therefore not demodulated from carrier to audio frequency at each headquarter but is passed through the headquarters carrier terminal equipment via a bandpass filter.

The second carrier channel is utilized as a direct channel in each section, KT-Hq.3, Hq.3-Hq.2, Hq.2-Hq.1, and Hq.1-Sui.

At each major station the audio circuit and appropriate carrier channels are terminated on a switchboard (at Karachi and Sui a 25 line cordless type and at the headquarters stations a 10 line cordless type). Telephones are provided in offices and quarters at each station for local internal communications and with access to the trunk circuits. Trunk circuits can be connected through at any station—for example calls from Karachi can be put through to Hq.1 either via Sui or via Hq.3 and Hq.2.

The third carrier channel is utilized for teleprinter traffic. The channel is demodulated to audio frequency at each headquarters station, but remains a four wire circuit throughout. The channel carries two teleprinter sub-channels, using single tone VHF operation, the tone frequencies being 420 and 1,020 c/s. The 420 c/s channel is used for a direct teleprinter circuit Karachi to Sui, while the 1,020 c/s sub channel is used within each section for teleprinter services Karachi-Hq.3, Hq.3-Hq.2, etc. At the headquarters stations this channel can be connected through to enable teleprinter traffic to be handled directly—Karachi to Hq.1, for example.

Since traffic between Karachi and Sui depends on every intermediate station operating correctly, it was considered desirable that radio equipment be duplicated throughout, and to enable system maintenance to be controlled from Karachi, means had to be provided whereby each station could be individually changed from main to standby equipment by operation of a switch at Karachi. This is achieved by switching tones in the bank 3,000-6,000 c/s; each station is allotted a characteristic tone, and has a tone receiver which operates the changeover relays on receipt of its characteristic tone. For monitoring the operation of the link a pilot tone is transmitted Karachi-Sui and Sui-Karachi. The frequency band 6,000 c/s is filtered through at each headquarters station along with carrier channel one, so that tones in the bank 3,000 c/s, transmitted at Karachi, are present in the baseband output at every station on the line.

During the initial planning of the system, theoretical assessment was made of the signal strength to be expected over each link of the system, since upon this depends the final performance to be obtained. Unfortunately the value of such theoretical calculations is limited, due to factors of terrain which are usually unknown, and it is necessary to confirm the calculations on which system performance is based, by radio propagation tests between the sites to be used. A radio survey team was therefore despatched to Karachi in September, 1954, to undertake these tests.

The area is not very attractive for field operations, or for the working of electronic apparatus, and the following is a brief description of the conditions experienced.

Starting from Sui, the first 30 miles of the pipeline crosses open desert, descending to the Indus valley, where rock and sand give way to irrigated paddy fields. After the crossing of the Indus at Sukkur (70 miles from Sui), the terrain alternates for 160 miles between agricultural land and arrid scrub as far as Hyberabad (Sind). Thereafter for the final 120 miles to Karachi the route lies over rocky desert with low ranges of hills. The whole region is very dusty and subject to dust storms, and in summer temperatures of 115°F are normal, exceeding 120°F on occasions. Rainfall is slight and averages about six per annum. The winter climate is quite pleasant.

At this stage in the pipeline project, the station sites were untouched, and could only be found with difficulty by the aid of marker stones. The survey team had to be completely independent of outside help, except for gasoline, water and limited food supplies which could be obtained en route. The survey team was divided into two parties of two engineers each, and each party was equipped with a 90 foot portable mast with Yagi aerials, cables, and a gasoline-electric generator, complete camp

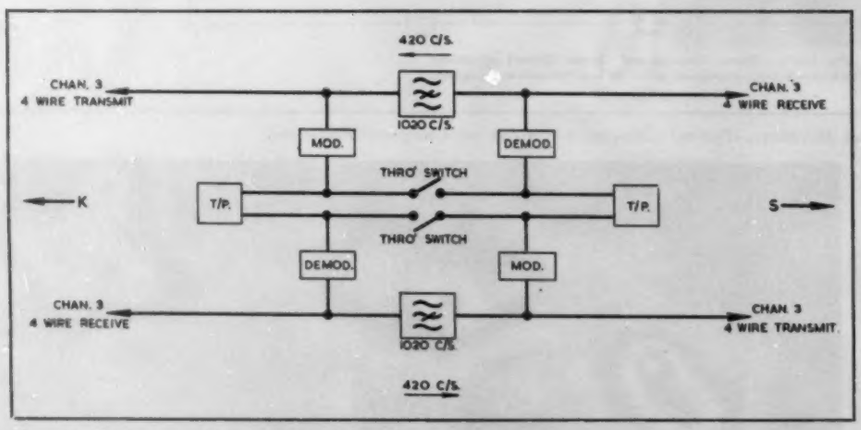


Figure 2—H. Station—Schematic Diagram of Telephone Channels

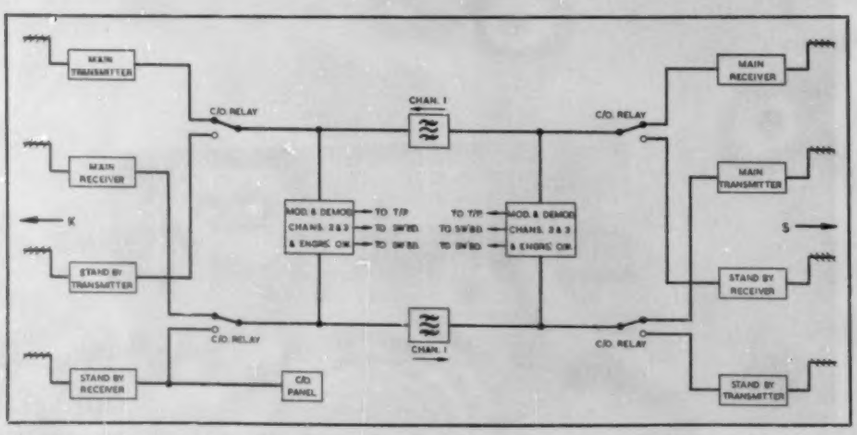


Figure 3—H. Station—Schematic Diagram of Telegram Channel

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equipment, and the radio test equipment which comprised VHF transmitters and receivers, signal generator for calibration and a chart recorder for maintaining a continuous and permanent record of signal strength during the tests. The transport at the disposal of the team comprised of two 1½ ton four wheel drive trucks and three jeeps.

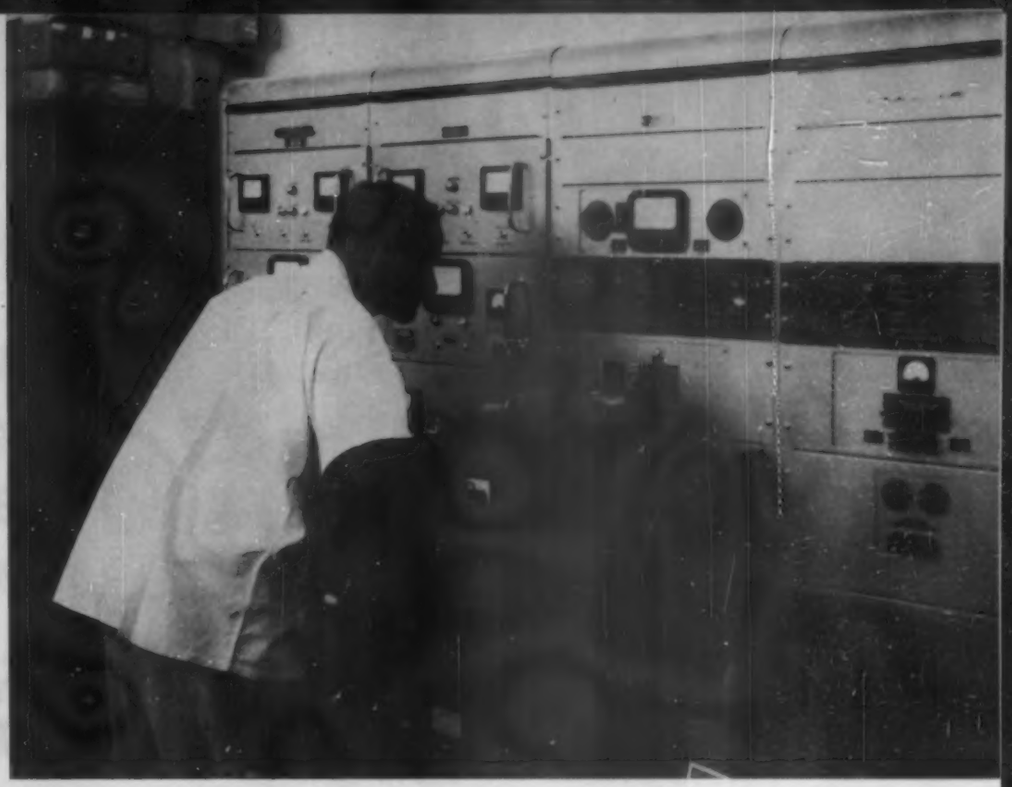
Each of the nine link sections was tested in turn for periods up to 72 hours continuously on frequencies of 71.1 Mc/s and 160 Mc/s. The tests on the two frequencies confirmed that the 70 Mc/s band was the more suitable, particularly on the longer links. Link length varies between 30 and 46 miles.

The initial planning was based on the use of 150-foot towers at each station and the survey measurements indicated that these heights would be adequate. Line of sight range over level terrain is 30 miles between 150 foot towers, so that a number of links were considerably beyond optical range. Some fading was experienced due to multi-path propagation on these long links, especially in the early mornings, but on a percentage time basis it was found that a service better than the specified minimum could be provided. The radio survey of the route was completed during November, 1954.

Manufacture of all the equipment for the system was already well underway by the time the survey was completed, and the greater part of it was inspected and put through functional tests in the factory in January and February 1955. Packing, shipment and customs clearance occupied a further two months, and in May the work began of moving equipment from Karachi to the stations on the pipeline. The material comprised about 55 tons of radio, carrier and telephone apparatus, packed in over 500 cases, and about 50 tons of steelwork for the ten 150-foot towers. The steelwork was taken over by Pakistan Constructors, who undertook erection of the towers, and this work was completed in about 11 weeks, together with erection of the yagi aerials by the Pye engineer who accompanied the erection team (of 10 Punjabi riggers). Meanwhile, as soon as the buildings at each station reached a state of sufficient completion, the equipment for that station was taken up country and unpacked. Almost the whole of the 50 tons of equipment was transported by two Austin 1½ tons trucks during May and June—the return distance for each journey being anything up to 1,000 miles.

Power supply became available at the pipeline stations during July and August and during this period the equipment at each station was tested and put into service, and on 19th August the first communications traffic between Karachi and Sui was put through the system.

At this stage the station buildings and power supply arrangements were far from complete, and the standby radio equipment at each station was not in commission due to a large amount of coaxial cable being held up by the United Kingdom dock strike.



A radio foreman checks radio and carrier equipment at headquarters on the Sui gas line.

All pipe line maintenance vehicles on the Sui line are fitted with Pye two-way radio-telephone. Here a pipe line engineer is calling back to Karachi terminal station from one of the gate valves.

It was decided, however, that the VHF communications system could be relied on for the filling and testing of the pipeline. For this operation, gas was admitted to the pipeline at Sui, and its progress down the line had to be detected at each gate valve and reported back to Karachi. Thereafter the pressure rise had to be reported hourly, and watch was kept for indication of a break in the pipe. Two breaks did in fact occur, and the faulty section had to be isolated immediately by closing gate valves, while a new section of pipe was welded into position. The whole pipeline was then raised to a pressure of 1,070 lbs. per square inch and checked for leaks over 24 hours, after which the Karachi end was vented to atmosphere through a flare; when this was lit the flare reached a height of 200 feet, and could be seen at a distance of 8 miles.

It will be appreciated that such an operation could not be attempted without reliable communications. At this time much of the pipeline route was flooded due to monsoon rain, and the extra security of the VHF radio system under such conditions was extremely valuable. To engineers of Pye Ltd. and Eriesson Telephones, Ltd., the successful completion of this crucial phase of a $28 million project was felt to be a worthwhile return for their share of all the efforts expended. END

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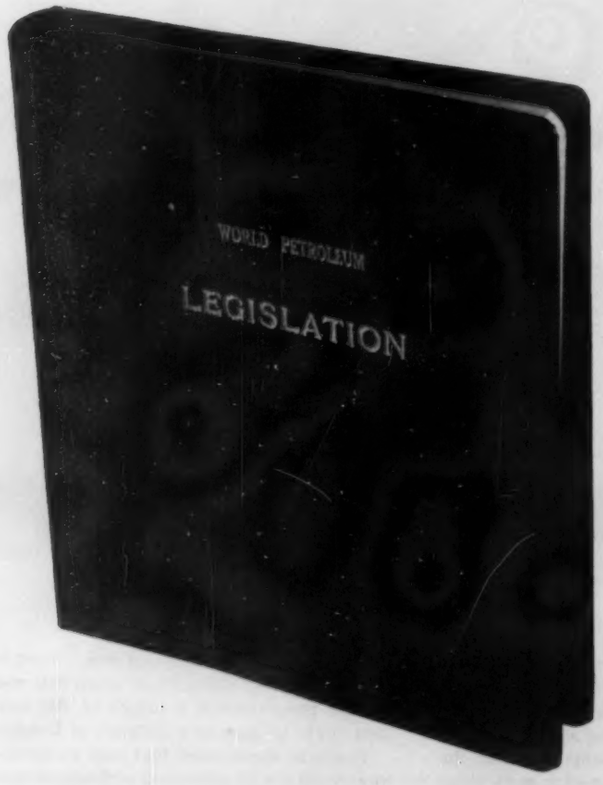

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Turkey
Venezuela
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Summaries are in loose-leaf form and are maintained current as required by the passage of new legislation.
They may be purchased in a single volume which contains summaries of all the countries listed, or on an individual country basis. Price range from $10 to $20 per country, up to $190 for the complete set, including revisions for one year.

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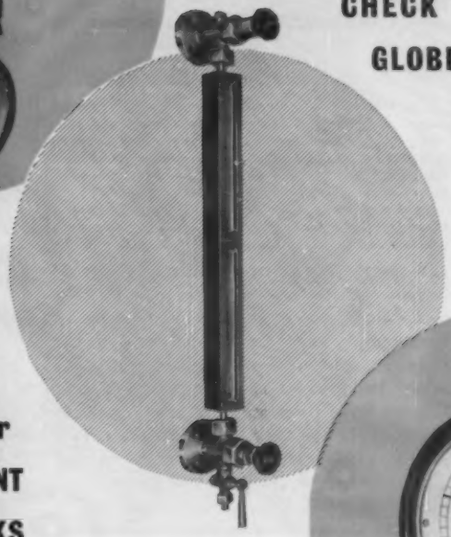

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Obsolescent Austrian Refineries Face Modernization Program

AUSTRIA occupies first place among the free European countries in crude oil production, but lags behind many a less productive country in refining, due chiefly to political reasons. The Germans from 1938 to 1945, increased crude production from 32,858 metric tons (657 b/d) in 1937 to 1,213,515 tons (24,270 b/d) in 1944, in their frantic search for oil to keep the war machine going. The Russians boosted production from 451,703 tons (9,034 b/d) in 1945 to 3,666,112 tons (73,322 b/d) in 1956 in an effort to produce as fast as possible under the Potsdam agreement.

Refining during all these years, especially under the 10 years of Soviet administration, was gravely neglected. During the German occupation two refineries were built in 1938, a 1.2-mile-long oil port on the Danube (1940/43) and a tank farm at Lobeau (1941/45). The Soviets repaired war damage in refining and storage installations but few new installations were commissioned during their occupation.

Throughput capacity of all seven refineries in 1955 was 2,210,000 tons (44,200 b/d). Throughput capacity of the two cracking plants was 450,000 tons (9,000 b/d).

The two oldest refineries (Kagran and Floridsdorf) were built before World War I. The two latest refineries (Moosbierbaum and Lobau) date back to the World War II period, while the other three were built in the period between. All are now obsolete.

At present, refineries permit only atmospheric distillation of crude at a reported processing cost of 232 schillings per ton ($1.19 per barrel) and thermal cracking. The products of the fractional distillation are straight-run gasoline with an average octaine rating of 62, kerosine, diesel fuel of good quality, gas oil, lubricating oils of medium quality and fuel oil. Yields are about 5% gasoline (octane rating 56-65), 30% gas oil and kerosine, 50 to 55% bitumen and heavy residues.

The two thermal cracking units are at the Schwechat and Moosbierbaum refineries. They operate inefficiently and at high cost. They produce besides diesel fuel, fuel oil, lubricating oils and asphalt, a gasoline with an octane rating of 64-72 which, after leading, can be upgraded to 75 octane number. Yields are about 30% gasoline (octane rating 64-68) from paraffin base, less than 30% (with octane rating 68-72) from asphalt base, 10% gas and 55% to 58% fuel oil. There are no installations for the utilization of refinery gas.

The refineries are capable of covering most of domestic requirements of petroleum products. High-quality products and specialties must be imported.

The most modern grease plant in Europe (shown above) is part of a blending installation and special products manufacturing plant recently brought into service by the Shell Group at its Wien-Simmering plant, in Austria. It will work in connection with the refinery of Shell Austria A.G. at Floridsdorf.

Shown above is general view of the main building showing (foreground) the truck loading ramp with drums awaiting delivery and (left) storage tanks.

When the Soviet troops entered Austrian territory at the end of World War II, they could claim five of the seven refineries as German property on the grounds of the Potsdam agreement of August 2, 1945. The other two refineries in Floridsdorf and Kagran have been and still are in private hands. Although they were nationalized *de jure* in 1946, the act could not be carried out, as their proprietors were nationals of the Western Allies. The regulations of property claims of nationals of the Western Allies were laid down in the so-called "Vienna Memorandum" of May 10, 1955.

The Floridsdorf refinery with a capacity of 200,000 tons per year (4,000 b/d) is operated by the A.G. der Shell-Floridsdorfer Mineraloelfabrik, an Austrian subsidiary of the Anglo-Saxon Petroleum Co. Ltd. According to the "Vienna Memorandum," which has not yet been carried out due to the rift in the government coalition, the refinery is to be returned to the legitimate owners. It was built before World War I, and enlarged and modernized in 1925.

The refinery at Kagran with a capacity of 180,000 tons per year (3,600 b/d) was also built before World War I. The "Vienna Memorandum" provides the return of the refinery to the legitimate owners, the Vacuum Oil Co., which bought it in 1925 and enlarged it in 1933/34 to its present capacity.

During the period of the Soviet occupation both refineries—like the others—were obliged to produce what the Soviets ordered. Their crude allocations were the first cut when runs to the Soviet-operated refineries were low.

The remaining five refineries were controlled by the SMOV (Soviet Mineral Oil Administration) from the end of World War II to August 13, 1955 with the exception of the Lobau refinery which was declared German property as late as July, 1955 and from then also controlled by the SMOV.

The refinery of the Fanto A.G. in Voesendorf was built in 1925 and has a capacity of 130,000 tons per year (2,600 b/d). It was transferred in 1938 to the A.G. der Kohlenwerkstoffverbaende, Gruppe Benzin-Benzol-Verband, Bochum, Germany, after its owners, the Oesterreichisches Credit Institut, Vienna, was absorbed into the German banking concern.

The refinery at Korneuburg was built in 1926/27. It has a capacity of 300,000 tons per year (6,000 b/d). At the end of World War II, it was in the hands of the Romanian oil company Creditul Minier S.A., which, in 1945, was incorporated with all its foreign assets into the Soviet-Romanian joint company SOVROMPETROL. According to the "Vienna Memorandum," the pre-World War II part-owners Anglo-Saxon Petroleum Co. Ltd., and Standard Oil Co. (N.J.) (25% each), relinquished their share in the refinery in return for an appropriate indemnity.

The refinery at Lobau with a capacity of 440,000 tons per year (8,800 b/d), was built during the first years of World War II by the Ostmaerkische Mineraloelwerke GmbH., Vienna, a company jointly owned 50% each by the Anglo-Saxon Petroleum Co. Ltd., and Socony Mobil Oil Co. It is now operated by the Oesterreichische Mineraloelwerke GmbH., which was founded by Shell and Socony before World War II. According to the "Vienna Memorandum," the refinery and the pipeline to the Zistersdorf oilfield is to be returned to the legitimate foreign proprietors. The refinery and pipe line, however, must first be denationalized. The future owners will have to pay an appropriate compensation to the Austrian state for those installations which were built during the period of the Soviet administration and increased topping capacity by 70,000 tons (1,400 b/d) to the present 440,000 tons per year (8,800 b/d).

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In case Austria is unable to fulfill its pledge to return the refinery to Shell and Vacuum, both companies are to be indemnified in money.

The refinery at Schwechat has a capacity of 660,000 tons (1,320 b/d) and a cracking capacity 250,000 tons per year (5,000 b/d). It was owned by the "Nova Oel-und Brennstoff A.G." In 1940, it was transferred to the Deutsche Erdoel A.G. (DEA). According to the "Vienna Memorandum," the refinery is to be returned to the "Nova Oel-und Brennstoff A.G.," whose capital is owned by Societe Francaise Industrielle et Commercielle de Petrole (SFICP). In addition, SFICP is to receive an appropriate indemnity which, however, is to be reinvested in the Austrian oil industry within 18 months.

The refinery at Moosbierbaum with a capacity of 300,000 tons (6,000 b/d) and a cracking capacity of 200,000 tons per year (4,000 b/d), was built in 1938 by the German Donau-Chemie A.G., Vienna. During World War II, it was enlarged by means of French booty installations. The Soviets therefore made only claims to the non-French part of the refinery. According to the "Vienna Memorandum," the French must be indemnified for their equipment in the refinery.

Both government parties agree that the refineries must be overhauled and modernized. Suggestions have been made to modernize the refineries without increasing their capacity, since unmarketable gasoline surpluses would be as undesirable as crude oil exports. Austria's present production of 3.6 million tons of crude (72,000 b/d) will probably remain constant for the time being. Since Austria has to deliver to the Soviet Union—according to the State Treaty—one million tons of crude yearly (20,000 b/d), for a period of ten years as payment for the oil fields in the former Soviet-occupied zone, and 200,000 tons of crude per year (4,000 b/d) for a period of six years as part-payment for other German assets, she has left at her disposal about 2.4 million tons (48,000 b/d) of which 2.2 million tons (44,000 b/d) can be processed and 200,000 tons (4,000 b/d) can be stored as reserve. An increase in throughput capacity therefore would not pay for the next few years.

Despite these limitations the Austrian Mineral Oil Board is planning a 350 million schilling ($14 million) investment program of modernization and rehabilitation, to begin during 1956. The largest share of expenditure will be for development, including 90 producing wells at about $5 million expenditure, plus 12 to 14 exploratory wells at about $1.6 million.

About 70 million schillings ($2.8 million) are to be spent on expansion and modernization of refineries, including improvement of LPGas facilities, storage and a pipeline from the Bockfliess fields to the Korneuburg refineries.

Utilization of natural gas has become important. From Austria's gas reserves, estimated at 706 to 1,060 billion cubic feet, some 21 to 35 million cubic feet of gas are being flared every day. An important part of the Austrian Mineral Oil Board's program calls for investment of about 65 million schillings ($2.6 million) in the purchase of compressors and natural gas facilities. According to figures released by the Austrian Central Statistical Office, refineries in Austria produced in 1955 the following quantities of products:

	Metric Tons
Gasoline	278,738
Kerosine	173,795
Gas oil	580,299
Fuel oil	1,128,468
Lube oils	58,653
	2,219,953

Austrian trade statistics reflect a distorted picture as they necessarily fail to show the uncontrollable exports of crude and products to behind the Iron Curtain, which the Soviets had carried out from 1945 until August 13, 1955, the day when all Soviet-operated enterprises were turned over to Austrian authorities, according to the State Treaty, signed in Vienna May 15, 1955.

The Soviets used to reserve for their own use about two thirds of annual crude production, while the remainder was allocated for sale on the Austrian market. For 1955, the Soviets allocated the following quantities of petroleum products:

Product	*Metric Tons*
Gasoline	175,000
Special and test benzene	8,500
Kerosine	22,500
Gas/diesel oil	202,500
Fuel oils	675,000
Lubricating oils	52,000
Asphalt	41,000

Fuel oil allocation for 1955 was 55,000 tons (1,100 b/d) smaller than the year before. This cut only aggravated the already existing shortage of this product.

Consumption of petroleum products in 1955 and 1954 was as follows:

Product	*1955 metric tons*	*1954 metric tons*	*Percentage change*
Gasoline	251,407	188,677	33%
Special and test benzene	11,119	9,941	+12%
Kerosine	23,354	25,106	— 7%
Gas/Diesel oil	274,370	224,316	+22%
Fuel oil	945,676	746,249	+27%
Lubricating oils	72,540	63,309	+14%
Bitumen	47,308	39,106	+20%
Total	1,625,774	1,296,704	+20%
(Total b/d	32,515	25,934)	

A comparison of both figure columns shows that with the exception of kerosine, consumption of all standard petroleum products increased in 1955 by 12-33% over 1954. Compared with what the Soviets allocated for sale in Austria in 1955, the figures likewise show that the quantities would not have covered Austrian requirements.

It must be borne in mind that only trade activity controllable by Austrian authorities could be registered, not that of the Soviets.

Total imports of products in 1955 were 381,014 tons (7,620 b/d), compared with 108,664 tons (2,174 b/d) in 1954. Exports in 1955 were 162,807 tons (3,256 b/d) compared with 1,927 b/d in 1954. No crude was imported. Crude exports were 10,229 tons (205 b/d) of which 10,007 tons (200 b/d) went to Poland and 2,222 tons (about 44 b/d) went to Western Germany. Gasoline imports rose from 30,582 tons (612 b/d) in 1954 to 97,194 tons (1,944 b/d) in 1955. Chief supplier in 1955 remained Italy with 87,813 tons (1,756 b/d) followed by France with 3,767 tons (75 b/d), Great Britain with 2,878 tons (57 b/d), West Germany with 2,309 tons (46 b/d), and smaller amounts from the Netherlands, Romania and Switzerland.

Of total gasoline exports of 11,969 tons (239 b/d), 8,381 tons (168 b/d) went to Czechoslovakia. Poland received 3,615 tons (72 b/d), and the rest went to Belgium, Luxemburg, and Portugal.

The 33% increase in gasoline consumption during 1955 compared with 1954 was due partly to the 30% increase in motor vehicles. By the end of October 1955, a total of 617,423 motor vehicles were counted, among them 143,054 passenger cars, 61,208 trucks, and more than 300,000 motorcycles.

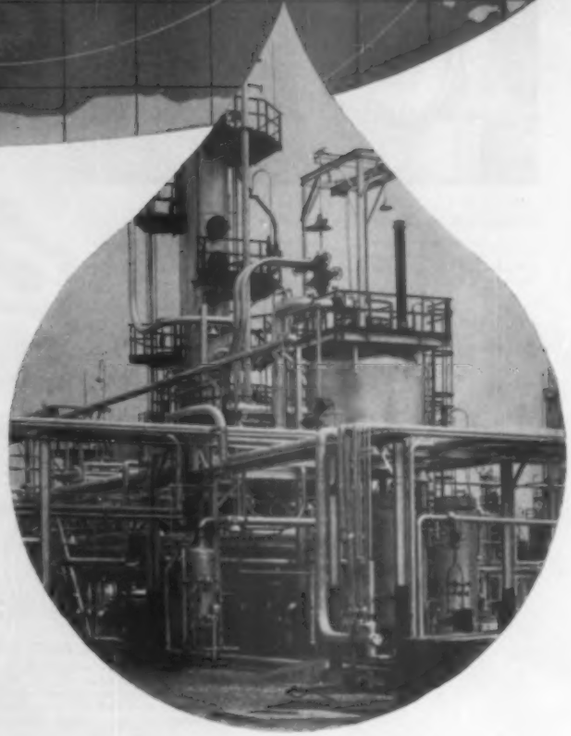
The pump price of standard-grade gasoline was reduced in November 1955 from 370 schillings per 100 liter ($0.539 per gallon) to 310 schillings ($0.457 per gallon). The maximum pump price for domestic premium-priced gasoline with an octane rating of at least 84 was fixed in February 1955, at 414 schillings per 100 liter ($0.603 per gallon) and reduced in November 1955, to 365 schillings ($0.531 per galllon). Despite the price cut, gasoline imports did not decline as expected, because domestic gasoline with an octane rating of 72-76 costs exactly as much after the price reduction as the cheapest import gasoline with an octane rating of 78-80.

Diesel fuel consumption rose by 22% in 1955 to 274,370 tons (5,487 b/d), of which 244,327 tons (4,886 b/d) was of domestic origin and 30,043 tons (601 b/d) imported. Imports were from Italy, 25,117 tons (482 b/d); from Yugoslavia, 4,206 tons (84 b/d); and the rest from West Germany. Exports totaled 123,689 tons (2,474 b/d) of which West Germany received 62,952 tons (1,259 b/d); Poland 32,122 tons (642 b/d); Czechoslovakia 25,962 tons (519 b/d) and the rest to Germany, Switzerland, and Romania.

Fuel oil consumption rose by 27% in 1955 to 945,676 tons (18,913 b/d) of which 767,974 tons (15,359 b/d) was of domestic origin and 177,702 tons (3,554 b/d) stemmed from imports. END

Throughout the World

Spence cobalt and molybdenum oxides on alumina catalyst is a sulphur resistant hydrogenation catalyst which is being used in increasing quantities at refineries throughout the world. It is a robust catalyst of high activity, proven by years of service on a commercial scale



Hydrofining unit, Esso refinery, Fawley. This is one of the many plants using Spence catalyst. Photo by courtesy of Esso Petroleum Company.

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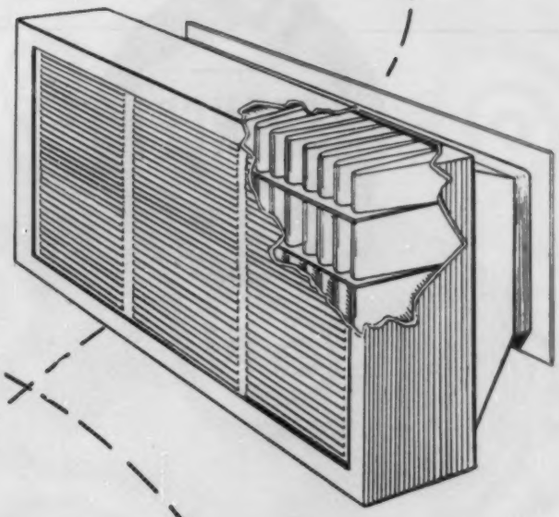
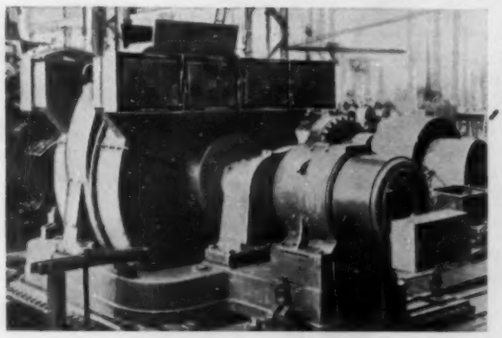
VOKES FILTERS

play a vital part in keeping the oil flowing...

In the blinding desert dust storms which sweep the area of the Iraq pipelines, VOKES filters have twice been chosen for the important task of protecting pumping stations and ancillary equipment . . . proof indeed of the important part which VOKES filtration is playing throughout the world in safeguarding plant and machinery from wear, breakdown and unnecessary depreciation. Below are shown three typical aspects of VOKES protection . . . protection which cannot be jeopardized by the non-availability of element replacements because VOKES FILTERS ARE CLEANABLE.





MICRO-VEE PANEL FILTERS FOR ELECTRIC MOTORS

Electric motors breathe too! . . . and these VOKES filters have proved conspicuously successful in preventing the grave damage hitherto sustained during operations in impure air conditions.

VOKES FILTERS FOR ANCILLARY EQUIPMENT

Compressors . . . portable generators . . . welding sets . . . power packs . . . all need protection against the ingress of abrasive dust, whether by air-intake, lubricating oil or fuel.

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Under abnormal conditions like these, engines have to be doubly protected and these large diesel engines are therefore fitted with Microvee dry fabric filters for cleaning the intake air. Vokes Filters are also specified for atmospheric air filtration in the ventilating systems of many of the desert buildings.

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2. **HEAVY-DUTY MAST** — is a 4-leg structural type, 96′ high, guyless, 150,000 lb. hook load with hydraulic power for raising and extending the mast.
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4. **POWER UNITS** — Cardwell offers a choice of engines and horsepower ratings.
5. **ROTARY TABLE DRIVE** — optional — hydraulic or mechanical drives are available.
6. **AUXILIARY AIR TANK** — on rear axle is provided, which will automatically set brakes in case of any air line failure.

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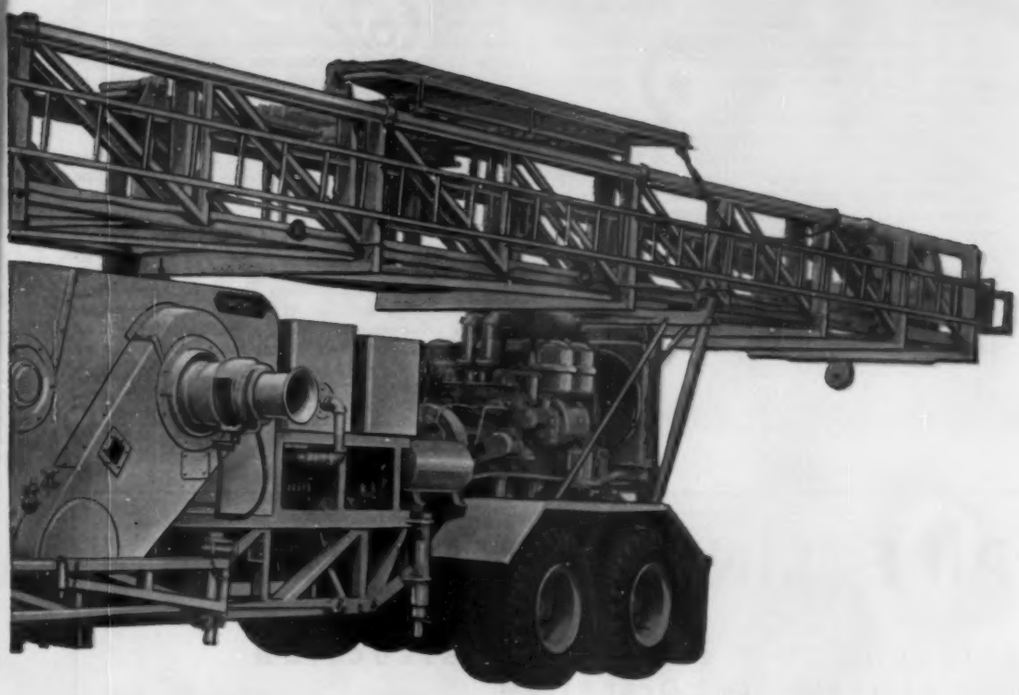

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A truly versatile heavy-duty self-propelled drive-in rig that can "turn on a dime." Servicing and workover to 13,000-feet, pulling 2⅞" tubing. Handles 4½" drill pipe to 4,000-feet or slimhole pipe to 6,500-feet.

New light alloy steels make it tougher... but lighter. Width and height within legal limits. Easily accessible clutches mounted outside of main frame, oversized brakes and drums for 3 wrap spooling with splash-water cooled brake flanges plus many other new features, make the new Cardwell M-250 the latest in utility and performance ... It's the first of many new things coming from Cardwell.

the new **cardwell** MANUFACTURING COMPANY

BOX 2001, WICHITA, KANSAS, U. S. A.

Suez Spotlight Needed

(*Continued from page* 61)

For many years Belgium drew its petroleum from Venezuela and other western sources. More recently a majority of supplies has come from the Middle East. Of the 2,900,000 tons of crude petroleum imported during the first six months of the current year, 1,070,000 tons were imported from Iraq, and 653,000 tons from Kuwait. Oil for heating purposes and other by-products are generally received from the same sources but by pooling imports with neighboring countries, or from the Dutch Antilles.

Reserves and the possibility of importing, should the worst occur, from the United States and Latin America permit Belgium to consider the future with confidence. There is however a darker side to the picture, namely, that consumption of coal has surpassed the country's production capacity.

This problem is also one of the major issues facing the European coal and steel community which, in order to prevent the situation from becoming a threat to its member-states' economies, has begun imports of American and even Russian coal from the Donets Basin.

The current shortage of coal and the threat hanging over Belgian petroleum supplies—despite the four-month stock reserves—is amply illustrated by the rush of consumers on every possible type of oil-burner this fall. Experts fear that this will in turn result in a serious demand on the country's supplies and may result in a temporary shortage in the petroleum field which will make itself painfully felt in transportation. Despite the fact that American supplies of coal could be increased, although this would create transport difficulties and shipping bottlenecks for a short period, a reconversion of much of the nation's transport system to coal would be virtually impossible.

Well along the road from all-out coal to total petroleum consumption Belgium, with its powerful refineries and tanking installations, depends, perhaps more than most other European countries, on the U. S. to keep the stream of oil flowing uninterruptedly should supplies from the Middle East be delayed. The U. S. Middle East Emergency Committee has its Belgian counterpart in the shape of the large petroleum companies here and government agencies responsible for keeping the nation's wheels running. END

The Super Tanker Problem

(*Continued from page* 79)

in ordinary weather should not exceed 30 minutes. Under these circumstances in normal operations, a ship can be loading or unloading its liquid cargo within 30 minutes after it has been secured.

A 100,000-ton tanker could discharge its full cargo to a facility on shore without the use of a single tug boat by means of a sea-unloading line.

Aside from the time and money saving aspects of a sea-loading or unloading system, such an installation offers many other advantages over the proposal to enlarge harbors.

From a safety standpoint, a submarine unloading system greatly reduces potential fire and explosion hazards presented by large volumes of petroleum products tied to highly inflammable tanker wharves and docks. This factor alone would result in a tremendous saving to oil companies and other principals involved, in the probable reduction of insurance rates.

From the standpoint of civil defense, the construction of storage facilities and sea-loading lines in sparsely populated areas would remove a prime enemy target (petroleum installations) from densely populated urban areas, and would thereby lessen the number of casualties resulting from a surprise enemy attack.

A single submarine unloading line can serve tankers carrying multiple cargoes simply by the manipulation of valves on shore. Many different products can be pumped through feeder lines to separate storage tanks without the products being intermingled.

The life of a properly constructed submarine sea-loading line can be estimated at a minimum of 50 years. Most of them can be expected to last much longer.

The submarine line is not vulnerable to damage from hurricanes, or other disturbances. Buried beneath the bottom of the sea, the line also escapes possible damage from marine organisms.

From its berth at sea, a tanker would never be endangered by winds of hurricane force while in port. In the event of a storm, the vessel could cast the mooring lines free, and head for the open seas in a matter of minutes—and without the aid of tugs.

Just as the super tanker has answered the problem of transporting larger quantities of oil more economically, submarine lines built out to sea will become the most expedient and the most economical means of loading and unloading giant tankers.

With the world's shipyards turning out bigger and bigger tankers every day, the construction of loading and unloading facilities is slowly but surely taking its place among the points of discussion at high-level conferences all over the world.

For an answer to the problem, three alternatives appear to be under consideration. Submarine pipe lines built out to sea is one answer. Discharging a portion of the super tanker's cargo onto smaller tankers outside the harbor is another; and the enlargement of present harbor facilities is still another.

Of the three, the installation of a complete sea-loading system, independent of the bulk materials harbor, for a fraction of the cost necessary for harbor enlargement, and in a fraction of the time required, is without doubt the most feasible. END

OIL PIPE LINE PUMPS

HIGH EFFICIENCY ROBUST CONSTRUCTION
RELIABLE IN OPERATION

STANDARD RANGE OF PUMPS WITH CAPACITIES
UP TO 30,000 BARRELS PER DAY

DISCHARGE PRESSURES UP TO 1250 LB/SQ. IN.

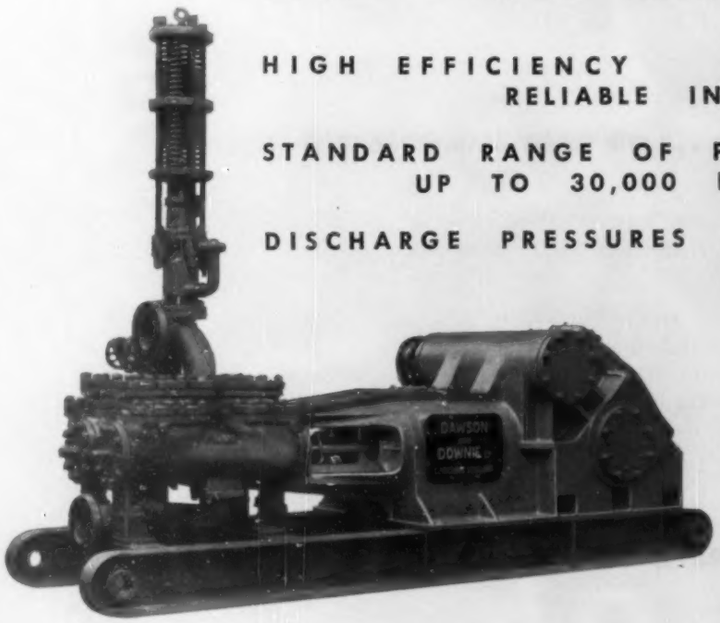

Illustration shows one of a series of pumps supplied to BRITISH PETROLEUM CO. LTD.'S refinery at ADEN, for pumping diesel and fuel oils from the refinery to the B.P. bunkering installation.

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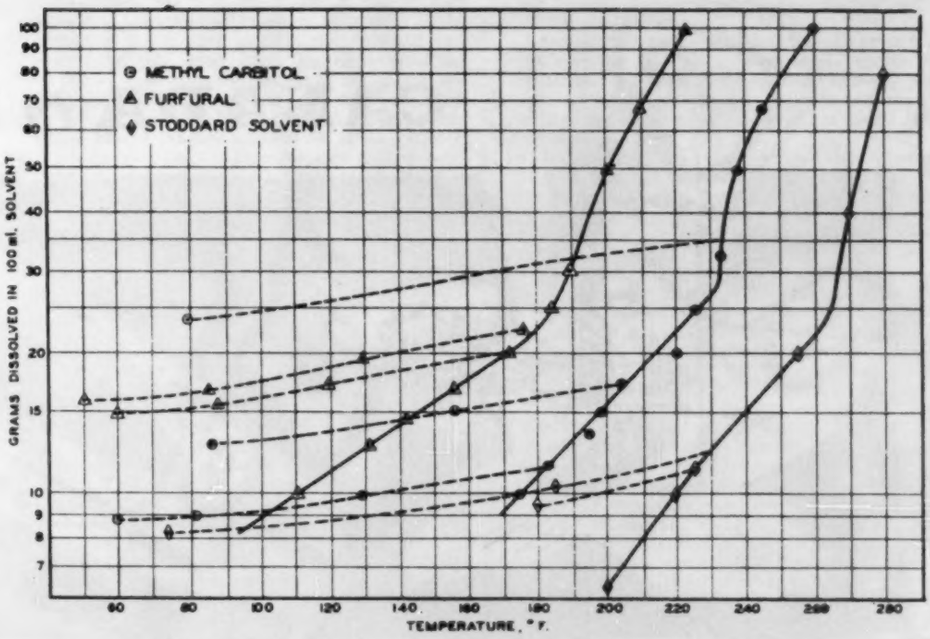
Review of U.S. patents on petrochemicals

By Heinz Heinemann and Harold Shalit



Solubility Curves, Crude Anthracene in various organic solvents. Patent No. 2,715,647.

The present review is devoted to a discussion of patents dealing with aromatic hydrocarbons, their preparation, separation and purification, and reactions. Aromatic hydrocarbons occur naturally in petroleum fractions or they may be made from petroleum fractions by various methods, such as dehydrogenation of C_6 ring naphthenes, dehydroisomerization of C_5 ring naphthenes, alkylation of aromatic hydrocarbons with olefins, etc. Their versatility and reactivity have made them a most important class of compounds for use as chemical intermediates and solvents. This importance is reflected in the number of patents reviewed here, a total of 42, most of them issued within the past year.

The patents are discussed in three groups, preparation of aromatic hydrocarbons, separation and purification, and reactions. In some cases the classification of a patent has been on a somewhat arbitrary basis since it is difficult at times to distinguish between preparation and separation. The three groups contain roughly the same number of patents.

Preparation of Aromatic Hydrocarbons—In 2, 711, 420, J. H. Brown and G. R. Martin (to Dow Chemical Co.) make aromatic hydrocarbons by reacting CO and H_2 over a catalyst comprising a metal of Group VII at 175°-225°C. The product from this stage is then passed over an aromatization catalyst comprising one oxide of a Group V or VI metal supported on a difficulty reducible oxide. The temperature of the aromatization is stated as 500°-650°C. A. Clark proposes to make p-xylene (2,741,646 to Phillips Petroleum Co.) by catalytically reforming a naphtha fraction boiling between 220°-300°F. The conditions for the reforming operation are 700-1000°F, pressure from atmospheric to 1000 psig, H_2: hydrocarbon mole ratios from 0.5-20, and liquid hourly space rates of 0.3-10. The xylene concentrate is separated from the reformate and crystallized at —70° to —115°F in order to recover a p-xylene concentrate. The uncrystallized material is isomerized over a solid catalyst, essentially synthetic silica gel containing from 0.1-2 wt. % of alumina, at 600°-1000°F, atmospheric —1000 psig, space rates of 0.3-10. The isomerizate is recycled to the crystallization step. C. Wankat, in 2,744,942 to Universal Oil Products Co., also uses catalytic reforming to prepare nitration grade aromatics from gasoline fractions. The effluent from reforming over a platinum catalyst is extracted with a solvent selective for aromatics. Final purification of the aromatic extract is accomplished by treatment with aluminum silicate or clay at 275°-800°F.

Naphthalene is made from a tetralin containing fraction according to 2,729,688 (J. A. Anderson, Jr. and E. J. Hoffman to Esso Research and Engineering Co.) by thermally cracking a fraction boiling between 350°-650°F. The thermal cracking zone is maintained at 1200-1400°F and 400-1000 psig; residence times in the reaction zone are from 2-120 seconds and H_2 is charged at the rate of 4000-10,000 std. cu. ft. 1 barrel. The product contains naphthalene which can be recovered.

A. W. C. Taylor, D. W. Jones, and M. L. Nobel (2,737,534 to Imperial Chemical Industries, Ltd.) claim to prepare p-xylene from 2,5-dimethylhex-3-ene-2,5-diol or 2,5-dimethylhexane-2,5-diol by reaction over chromia-alumina at 300°-750°C in the presence of hydrogen. In 2,737,535, the same inventors make p-xylene from 2,2,5,5-tetramethyl-2,5-dihydrofuran or 2,2,5,5-tetramethyl tetrahydrofuran. The process is carried out in vapor phase at 300°-750°C over chromia-alumina, platinum-charcoal, metals of Group VIII, or oxides of chromium, molybdenum, or vanadium. In a third patent (2,737,-537) these authors prepare p-xylene from 2,5-dimethyl-3-yne-1,5-diene. The conditions are 300°-600°C over a variety of catalysts including alumina, silica alumina gels, fluorinated aluminas and thoria-aluminas, zirconia-alumina, fluorinated titania-alumina, chromia-alumina, and chromia-alumina with minor amounts of magnesium chromate.

H. Pines (2,754,339 to U.O.P.) proposes a somewhat different approach to aromatization. He dehydrogenates bicyclic terpenes containing a six membered ring and a 3- or 4-membered ring. Such compounds are contacted with alkali metals or their hydrides at 100°-400°C and pressures up to 200 atmospheres. The reaction is carried out in the presence of an organic promoter capable of forming an organometallic compound with the catalyst, e.g. halogenated aromatics, organic peroxides, acetylenic hydrocarbons, etc. The example given shows the formation of p-cymene and 1,2,3-trimethylbenzene from α-pinene by treatment with sodium and o-chorolotuene at 150°-270°C.

The next group of patents is concerned with alkylation of aromatics with olefins to produce higher aromatics. These, obviously, could also have been discussed in our previous article on olefins. H. S. Bloch and G. L. Hervert (2,737,536 to U.O.P.) make tertiary alkyl aromatics by treating an aromatic hydrocarbon, containing nuclear hydrogen, with an acidic alkylation catalyst in the presence of a tertiary paraffin. There must also be present an olefin containing at least three more carbons than the paraffin. The aromatic compound should be in molar excess over the olefin. In 2,744,150, H. I. Enos, Jr. suggests a method for preparing di-isopropyl benzenes free of the ortho-isomer and trimethylindane. Benzene is reacted with a propylene containing gas at as low a temperature (in the range of 30°-150°C) and in the presence of the smallest amount of catalyst which will cause reaction to a mixture rich in polyisopropyl benzenes. The polyalkylates are separated from the alkylation mixture and mixed with benzene so that the proportion of isopropyl groups to benezene is about 2:1. Reaction is then caused to take place at 65°-115°C in the presence of 0.1-2 mole % of $AlCl_3$. The disproportionation is continued until the mixture is enriched in m-di-isopropylbenzene. E. V. Kirkland (2,740,819 to American Oil Co.) patents a method for preparing 1-isopropyl-2,4-dimethylbenzene (an intermediate in the preparation of substituted indanes). m-Xylene is mixed with $AlCl_3$ containing added water in amounts about 75% of that needed to hydrate the $AlCl_3$. Propylene is introduced in mole ratios to xylene of 0.5-2 at 20°-150°C and sufficient pressure to maintain the liquid state. The monoisopropyl fraction of the product contains the desired isomer as its principal constituent. The same inventor, in 2,754,341, prepares propylated aromatics by reacting aromatics with propylene at 20°-150°C in the presence of a catalyst consisting of solid phosphoric acid saturated with BF_3. The BF_3 and propylene are continuously introduced throughout the reaction time in a ratio of BF_3: aromatic of 0.02-0.1 moles/hour. It is claimed that continuous introduction of BF_3 prolongs catalyst life.

In 2,748,178 (H. Pines and V. N. Ipatieff to U.O.P.) react olefins and aromatics or hetercyclic aromatics having alkyl groups containing α-hydrogen. The reaction temperature is 100°-350°C at pressures from 5-50 atmospheres and in the presence of an alkali metal catalyst and an organic peroxy compound as a promoter. For example, toluene and ethylene react to give mainly n-propylbenzene.

Separation and Purification of Aromatic Hydrocarbons—The following section discusses those patents describing separation and purification processes for aromatic hydrocarbons. The first group of patents, deals with crystallization methods for separation. In 2,695,323 (J. H. Arnold to California Research Corp.) p-xylene is recovered from a mixture with the other xylene isomers by chilling the fraction to —75° to —120°F. The chilled material is charged to a crystal forming zone containing p-xylene crystals in liquid xylenes. The liquid xylenes from the crystal forming zone are continuously circulated through a chiller at a temperature below that in the crystallizing zone and are then recycled to the crystallizing zone. R. R. Coats and D. W. Ingram (2,705,248 to Imperial Chemical Industries) claim the production of p-xylene from a xylene feed stock. They first charge the stock to a zone cooled to —65°C in order to sep-

(*Continued on page* 126)

BP GOES TO ANTARCTICA

THE TRANS-ANTARCTIC Expedition is being supplied with petroleum fuels and lubricants exclusively by The British Petroleum Company.

Sir Edmund Hillary, leader of the New Zealand Party, is here seen driving a tractor, while his second in command, Mr. Bob Miller, supervises the unloading of aircraft fuel at the stores dump near Shackleton Base.

The British Petroleum Company is proud of its association with the Expedition—a tribute to the high quality of all products marketed under the BP Shield throughout the world.

The BP Shield is the symbol of the world-wide organisation of

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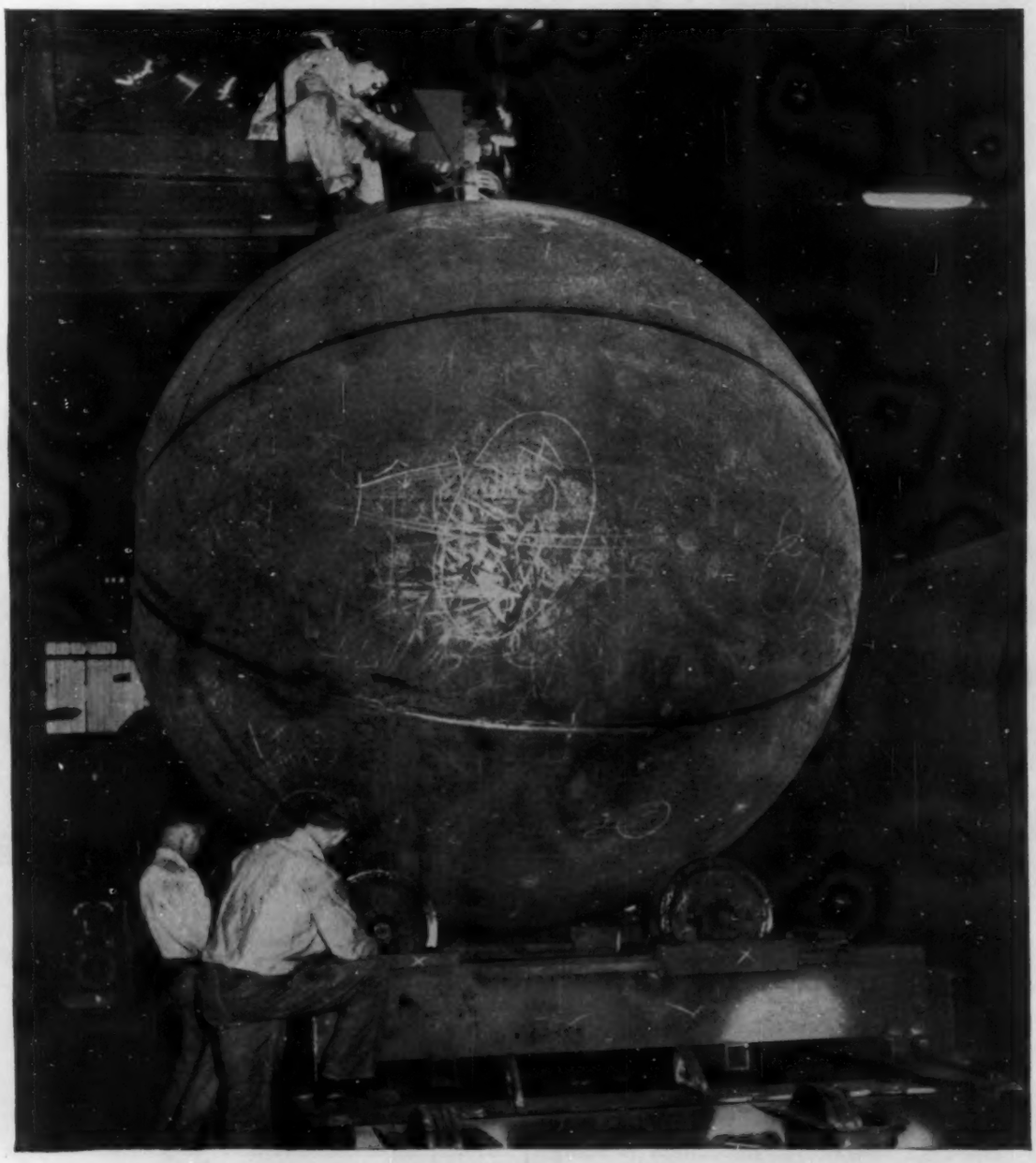

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needed, some way to cool off hot-tempered worms!

AFTER the worms were heated and quenched, their threads were not uniform. Distortion had already destroyed the precision machining so vital for efficient operation and long life.

Technicians traced the trouble back to the tempering process. The soft steel had hardened unevenly and warped. The result: crooked worms with uneven tempers.

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Available quenching fluids were not doing the job. A superior one was indicated. So – Texaco went to work on a tough problem – came up with the answer – a fluid that equalized metal tempering as never before.

Now the hot steel could be quenched uniformly. Result: true and smooth-turning worms with even tempers!

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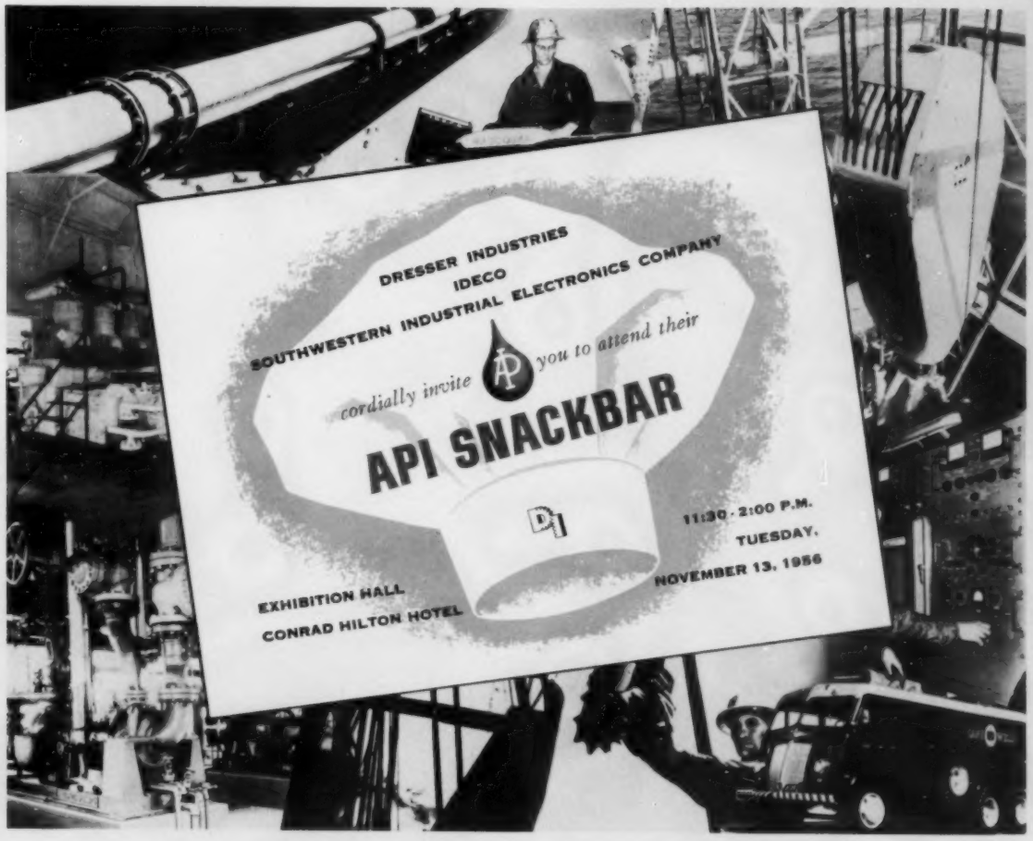

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November 12-15, 1956

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DRESSER-IDECO COMPANY, Columbus, Ohio—Radio and television broadcasting towers, steel buildings, aircraft hangars, electric power substations.

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LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, bridging plugs.

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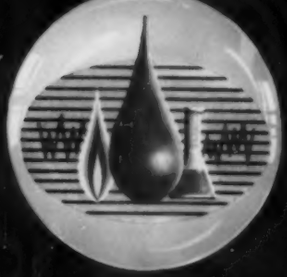
PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

ROOTS RC CONNERSVILLE

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.



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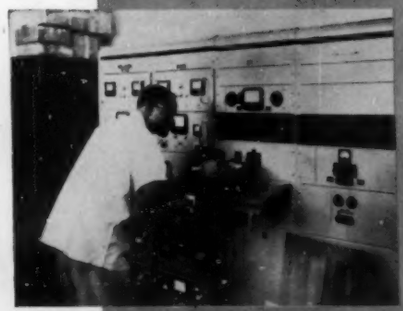
COMMUNICATIONS SYSTEMS



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From initial planning to final commissioning, Pye can cover every stage of radio communications systems. The illustration shows the system which controls gas flow and maintenance along the 350 miles of the Sui-Karachi gas pipeline. This was engineered by Pye in collaboration with Ericsson Telephones Ltd.

Direct telephone and teleprinter circuits between Karachi and Sui and to three intermediate Headquarters stations are provided, together with telephone service to the Repeater stations, and telephone distribution at major stations. The backbone of the system is the V.H.F. multi-channel radio link and carrier equipment which connects Karachi to Sui via the three inter-

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Pye Mobile Radio-telephones are fitted to all maintenance vehicles so that they can be called immediately to any part of the pipeline. Initial maintenance of the system and training of local staff was also undertaken by Pye engineers, and a complete working organisation has now been handed over to the Sui Gas Transmission Company.

Pye have recently been awarded a further contract to provide the communication system for an extension of the gas pipeline to Multan, 200 miles north-east of Sui. The facilities provided on the extension of the system will be identical with those available on the Karachi to Sui section with the addition of a "through circuit" from Karachi to Multan, a distance of 550 miles.

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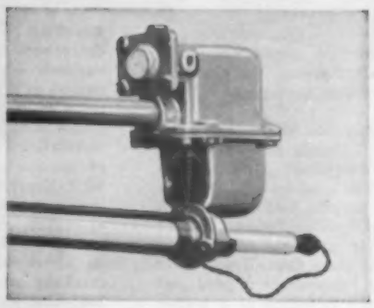

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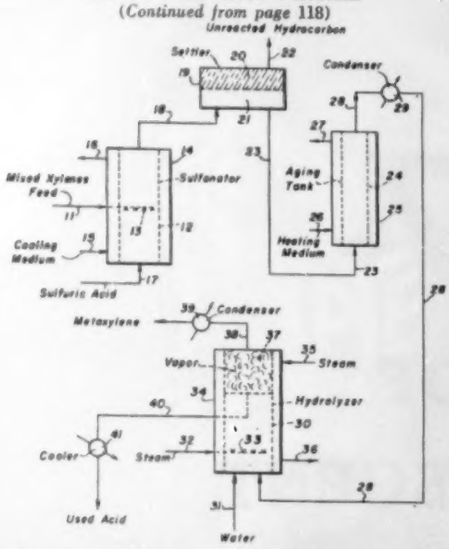
Review of U.S. Patents

(*Continued from page 118*)



Pat. No. 2,688,644. Purification of Metaxylene. A. J. Shmidl et al, filed Sept. 1, 1950.

arate out the p-xylene. The resultant mother liquor is isomerized in the vapor phase at 400°-500°C with a catalyst selected from the group of alumina, zirconia, titania, thoria, beryllia, and silica. The catalyst contains less than 0.1% alkali and is activated by fluorine or fluorine compounds. Benzene and toluene formed in this reaction are removed overhead from a subsequent distillation and trimethyl benzenes are taken off as bottoms. The xylene fraction is recycled to the cooling zone. An improvement in the crystallization of p-xylene is patented by B. R. Tegge (2,724,007 to Esso Research and Engineering). The p-xylene crystals from a 130°-160°C cut cooled to —40° to —90°C are washed with a cold solution in water of a polar organic oxygenated compound, e.g. methanol. The solution should be at a temperature low enough to be immiscible with the hydrocarbon and should have a different density. The washed p-xylene crystals are filtered and the mother liquid is separated into an aqueous and hydrocarbon phase. The aqueous phase is recycled to the washing step.

R. B. Bennett (2,665,316 to Standard Oil Development Co.) separates durene from other tetramethyl benzenes contained in aromatic cuts boiling from 350°-425°F. The feed is chilled to —95° to —105°F in 4-10 hours to form a first slurry which is maintained at this temperature for 4-10 hours. The slurry is warmed in 15-60 minutes to —25° to —75°F and filtered. The crystals are heated and melted at 110°-150°F and then cooled to 80°-105°F, whereby substantially pure durene crystals separate.

With a slightly different technique L. D. Kleiss and S. J. Marwil of Phillips Petroleum Co. (2,715,-647) separate and purify anthracene. The crude anthracene is dissolved in a solvent comprising a mono-alkyl ether of diethylene glycol containing 1-4 carbon atoms in the alkyl group. The resulting solution is cooled to crystallize anthracene of improved purity.

Several patents were concerned with solvent extraction of aromatics. W. T. Nelson in 2,737,538 (to Phillips Petroleum Co.) proposes 2-pyrrolidone (B. P. 245°C, M. P. 24.6°C) as a solvent for the separation of aromatics from paraffin hydrocarbons. In 2,754,342 (R. O. Shelton to Phillips Petroleum Co.) an aromatic concentrate is produced from light cracked gasoline containing more than 50 vol. % of olefins and aromatics. The concentrate is produced by solvent extraction in the presence of a higher boiling fraction substantially free of aromatics. The phases are separated and enriched aromatics are recovered from the extract and the high boiling fraction is subsequently cracked. J. L. Talbot of California Research Corp. (2,738,372) separates xylene isomers by making a mixture of equimolar portions of o- or p-xylene (or both) with BF_3 in an excess of HF. This is then contacted at —50° to 120°F and 20-100 psig with a mixture of m-xylene and one other xylene. The hydrocarbon phase then consists of a mixture of o- and p-xylene, while the HF phase contains essentially m-xylene. According to D. A. McCaulay and A. P. Lien of Standard Oil Co. (Indiana) (2,753,386) 1,3,5 ethylxylene may be separated from m-diethylbenzene by contacting the mixture with an agent containing one mole BF_3 per mole of 1,3,5 ethylxylene and sufficient HF to form a liquid phase. The temperature is kept below 50°C and time is allowed for equilibrium to be attained. Essentially pure 1,3,5 ethylxylene is contained in the acid phase.

The next three patents deal with extractive and azeotropic distillation. V. A. Johnson (2,721,170 to Sinclair Refining Co.) separates o-xylene from isomeric xylenes by charging to extractive distillation a xylene concentrate in the vapor phase at 300°-320°F. The solvent used in the distillation is a high boiling organic compound boiling above o-xylene and selective for o-xylene under process conditions. The bottoms from the distillation contain o-xylene and solvent. In 2,736,691 (to Phillips Petroleum Co.) W. T. Nelson claims that mono-alkyl aromatics may be fractionated from close boiling polyalkyl aromatics by using PBr_3 as an entraining agent. W. F. Yates and P. C. Kelly of Monsanto Chemical Co. (2,752,295) use diacetone alcohol as an azeotroping agent to separate vinyl toluene from ethyl toluene. The distillation is carried out at pressures below 20 mm and temperatures below 100°C in the presence of a polymerization inhibitor. The diacetone alcohol-ethyl toluene azeotrope is taken overhead.

Chemical methods of separation are used in the following patents. In 2,688,644, A. J. Shmidl and J. M. Powers of Standard Oil Development separate m-xylene from other C_8 aromatics by contacting the mixture at 60°-125°F with H_2SO_4 of 75-95% concentration. The acid layer is separated and maintained at 200°-250°F for 1-3 hours; it is then hydrolyzed at 280-287°F to recover m-xylene. In 2,733,281 (R. R. Dreisbach and R. A. Martin to Dow Chemical Co.) p-divinyl benzene is separated from its isomers by reaction with concentrated HCl at 0°-30°C. The crystalline p-di-(α-chloroethyl) benzene is separated from the liquid isomers. The final step consists in removal of HCl to give p-divinyl benzene, e.g. by hydrolysis to p-di-(α-hydroxy-ethyl) benzene followed by dehydration. M. J. Schlatter of California Research Corp. (2,734,930) suggests a method for separation of ethyl benzene from the xylenes. He selectively alkylates the ethyl benzene with tertiary alkylating agents sufficient in quantity to alkylate the major portion of the ethyl benzene. The alkylate is distilled and t-alkyl ethyl benzene separated at bottoms from which ethyl benzene can be recovered, e.g. by catalytically cracking the tertiary alkyl group off or by disproportionation with other aromatic hydrocarbons or phenol.

R. M. Love (2,753,387 to Esso Research and Engineering Co.) purifies crude 95% benzene containing olefins. The crude material is treated with H_2SO_4 followed by an alkali metal hydroxide wash with 1-10 molar MOH at 250°-350°F for 20 minutes. The washed benzene is distilled in admixture with 2-10% of a flux oil of true boiling point not more than 70°F above benzene and a distillation range of not more than 100°F. The middle fraction contains pure benzene.

Reactions of Aromatic Hydrocarbons—Aromatic hydrocarbons are useful for the great variety of conversions which they can undergo. There are discussed in this section a few examples of such reactions which were judged of greatest interest to the petrochemical industry.

Alkylated aromatics can undergo isomerization of various types. In 2,719,183, E. R. Boedeker and W. E. Erner of the Houdry Process Corporation propose a process for the isomerization of C_8 and higher aromatics, e.g. m-xylene to a mixture of the isomeric xylenes. They pass the charge stock over an isomerization catalyst, comprising a siliceous cracking catalyst, at temperatures in the range of 850°-1250°F, space rates of 0.1-3.0, and pressures not above 0.5 atmospheres. D. A. McCaulay and A. P. Lien (2,741,647 to Standard Oil Co. of Indiana) patent a procedure for isomerizing a mixture of secondary alkyl toluenes to the meta isomer. The mixture is treated with one mole of BF_3 per mole of alkyl toluene, using sufficient HF to allow a complex to form. Temperatures are maintained around —30°C and sufficient time is allowed for isomerization to take place but not enough for disproportionation. The m-secondary alkyl toluene is recovered by removing the HF-BF_3 or, alternatively, using a displacer consisting of a polyalkylbenzene. H. I. Enos, Jr. of Hercules Powder Co. (2,744,149) isomerizes a mixture of all the cymene isomers to one containing substantially only the para and meta isomers. The charge mixture is contacted with 0.1-2.0 mole % $AlCl_3$ at 80°-150°C under isomerizing conditions. The resultant mixture is then separated from the catalyst.

Disproportionation and dealkylation are the subjects of the following group of patents. H. Clough (2,709,193 to Imperial Chemical Industries, Ltd.) claims the dealkylation of monocyclic aromatics by treating them with hydrogen at temperatures above 500°C and pressures above 100 atmospheres. A catalyst is used comprising aluminum silicate and ferric fluoride. This same inventor in 2,709,194 claims to accomplish the same reaction by using a catalyst which is essentially aluminum phosphate. The disproportionation of poly-n-alkyl benzenes to mono-n-alkyl benzenes is proposed by A. P. Lien and D. A. McCaulay (2,753,383 to Standard Oil Co. of Indiana). They react the polyalkylated material with benzene in the ratio of one mole of benzene per mole of alkyl group in the presence of at least 3 moles of liquid HF per mole of feed and with BF_3 in the ratio of 0.2-0.8 moles per mole of feed. Temperatures are maintained between 0°-120°F with sufficient time being allowed for appreciable mono-n-alkyl benzene to form. The HF and BF_3 are then removed to recover the mono-alkyl benzene. Conversely, the same inventors in 2,753,384 produce poly-n-alkyl benzenes from mono- and di-n-alkyl benzenes. This is accomplished by contact with 0.3 mole BF_3 per mole alkyl groups and sufficient HF to form a separate acid phase. Temperatures are in the range —10° to 100°C. The polyalkylate is found in the acid phase.

Aromatics may be incorporated in various polymers. In 2,719,131, L. A. R. Hall of E. I. du Pont de Nemours claims the production of poly-p-xylene or its alkylates. This is accomplished by a pyrolysis of gaseous p-xylene and chlorine in which the concentration of gaseous p-xylene is at least equal to that of the chlorine. The polymer so produced is useful as a coating or in the manufacture of shaped articles. J. A. Anderson and E. J. Hoffmann (2,754,340 to Esso Research and Engineering Co.) make aromatic polymers and solvents by pyrolysis of a fraction boiling between 100°-900°F and containing aromatic and saturated hydrocarbons. The pyrolysis is carried out between 1100°-1200°F at pressures from 0-300 psig for 1-50 seconds and in the presence of hydrogen. The product is rapidly quenched to below 200°F within 30 seconds and then distilled under reduced pressure at temperatures below 200°F. Unsaturated aromatics in the middle fractions are polymerized at 300°-500°F to form high boiling polymer leaving purified aromatic hydrocarbon solvent. In 2,752,387, assigned by C. E. Rehberg to the Secretary of Agriculture, the formation of telomers of iso-propyl benzenes and alkyl-acrylates is claimed. These are made by maintaining the iso-propyl benzene at its boiling point while dissolving in it a monomeric C_7-C_{11} alkylacrylate at a rate equal to that at which polymerization takes place. There are produced stable, low molecular weight, liquid telomers of the two reactants.

Some miscellaneous reactions are now discussed, H. E. Mammen (2,718,526 to U.O.P.) produces alkyl aromatic sulfonic acids by alkylating an aromatic hydrocarbon with a C_9-C_{18} olefin in the presence of an H_2SO_4 alkylation catalyst. The resultant alkylate is sulfonated with H_2SO_4 oleum, and the used oleum from the sulfonation is supplied to the alykylation step to constitute at least a part of the alkylation catalyst. In 2,739,174, D. V. Ross of the Eastman-Kodak Co. patents a process for the manufacture of nitrated aromatics which azeotrope with water, e.g. nitrobenzene, nitrotoluene, nitroxylene, etc. The aromatic hydrocarbon charge is contacted with excess HNO_3 in a reaction zone at 100°-120°C. The liquid reaction mixture, free of hydrocarbon, and consisting of H_2O, HNO_3, and nitrated hydrocarbon is withdrawn below the surface of the liquid in the reaction zone. It is then distilled and the water-nitrated aromatic azeotrope is taken overhead. E. H. Polak (2,752,404 to Polak's Frutal Works, Inc.) makes polyalkyl indanes by reacting p-cymene with secondary or tertiary alcohols or tertiary olefins. The alkylating agent should contain 4-12 carbons and be present in the ratio of 1/2-1/3 mole per mole of p-cymene. The catalyst used is sulfuric acid of 85-93% concentration, and the temperatures are from —20° to 50°C.

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International News and Notes

Dry Well Completed in India

Assam Oil Co.'s Well No. 15 in Tengakhat, Hugrijan prospecting license area, has been completed dry. Since mid-1953 18 wells have been completed in the alluvial areas of the Brahmaputra Valley of Upper Assam, of which four, including this Tengakhat well, were dry. Drilling equipment has been moved to Langkasi, a new location in the Hugrijan area.

This result indicates the field to the north-west of the original discovery well at Nahorkatiya is less than was expected. Meanwhile Well No. 19, north of the discovery well, is drilling ahead and work on other new locations is also in progress. Well No. 1 at Moran, between Sibsagar and Lakhimspur sub-divisions, is now, 13,739 feet deep.

Sui Gas Expansion

The construction of a natural gas line from Sui to Multan and then to Lyallpur and Lahore by the Pakistan Industrial Development Corp. at a cost of Rs 28 crores ($58.8 million) is planned. Plans have been divided into four phases for the transmission of Sui gas to northern areas of the province. The first phase is to lay a 220-mile pipe line from Sui to Multan via Kashmore, Rahimyar Kha, Uchn, Zahirpur and Shujabad. The first consignment of about 3,100 tons of 16-inch diameter pipe has already reached the site for the 220-mile pipe line from Sui to Multan. The actual laying of the pipe line began in October and will be completed before July 1957.

The second phase consists of a 137,000 kw Sui gas power station at Piran Ghaib near Multan at an estimated cost of Rs 105,000,000. The site for the power station has already been selected and acquired and orders for boilers and turbines also placed with foreign firms. A 220 kw transmission line 170 miles in length will inter-connect the existing electric grid at Lyallpur, in the third phase. This is expected to cost Rs 28,000,000.

In the fourth phase, the PIDC will further extend the Sui gas to Lahore via Lyallpur. This is estimated to cost Rs 90,000,000.

This will make power available to the entire northern areas of West Pakistan, especially Rahimyar Khan, Multan, Lyallpur and Lehore.

More Exploratory Drilling in Kuwait

A major discovery on a new structure some 60 miles north of the present producing area in Kuwait followed the drilling of a test well designated Raudhatain No. 1. A second test at a location 1.8 miles southeast of Raudhatain No. 1 was spudded on December 12, 1955. This second well, designated Raudhatain No. 2, was drilled to a total depth of 9,695 feet. A smaller rig has been moved in to complete testing. The drilling rig was moved from Raudhatain No. 2 to a location approximately 8 miles to the east-southeast known as Sabriya No. 1 and is now drilling. An additional exploratory well is drilling at a location approximately 6 miles northwest of Bahrah No. 1, the first test well in the state of Kuwait which was drilled in 1936 and resulted in the first and only dry hole to date.

Tankers in the USSR

Between 1953 to 1955, the Soviet Union built about 20 tankers of the so-called "Leningrad" class (10,000 tdw, two two-stroke Diesel motors with 2,000 hp each, velocity about 13.5 knots), according to Swedish sources.

The sources said the Soviet Union is now studying the construction of several turbine tankers (42,000 tdw, velocity 18 kilometers/11.18 miles) which will also meet the requirements of the navy.

According to Soviet sources, the capacity of pipelines will be stepped up by 1960 about six times over 1955. 8,073 miles of oil pipelines are to be transferred to automatic control, with the central panel in Ufa.

Egyptian Oil Forgery

The below statement was contained in an official Egyptian brochure for general information on Egypt. The Embassy of Egypt has since issued a brochure without the below paragraphs, and announced that the first was a forgery. The statement defined one of Egypt's "Major Projects" in oil as follows:

"Formation of an Egyptian-controlled pan-Arab marketing organization to ensure that all Middle East oil is used for the benefit of Egypt and the Arab countries. While Egypt's enemies will thus be deprived of oil, Arab countries enjoying the goodwill of Egypt will have their supplies assured.

"Since most of the Middle East oil already goes through the Suez Canal, Egypt is the natural center for the future pan-Arab marketing organization. By using the network of facilities left behind by the Imperialists in the Canal Base, Egypt will be able to provide expanding facilities in the Zone, including large-scale storage and refineries to be built with the help of her new allies.

"Sales will be exclusively conducted by the new organization, which will also determine prices, transit dues, royalties and taxation. Owing to the strategic position of the Suez Canal, other Arab oil-producing countries will find it advantageous to join the pan-Arab marketing organization while Egyptians, by virtue of their control of the Canal, their unrivalled commercial experience and their exclusive access to Soviet-bloc supplies (equipment, tanks, tankers, pipelines, etc.), will undertake the building and management of the new base.

"In return Egypt's oil resources which now cover two-thirds of her needs, will be added to those of Saudi Arabia, the Persian Gulf and other Arab countries. This will add two million tons of Egyptian crude oil to the annual output in the Middle East countries now amounting to 135,636,000 tons. The establishment of the pan-Arab marketing organization will therefore solve Egypt's own oil problem. Through increased exploration of her oil deposits, for which adequate capital has so far been lacking, it is expected that indigenous production will soon be raised to a more satisfactory level.

"This pan-Arab marketing organization will make the Arabs masters of their oil. That is why president Gamal Abdel Nasser and the Government are determined to go ahead on these lines. It is the logical way to unite and strengthen the Arab world under their leadership."

Russia Surrenders Iranian Wells

M. Victor Ivanovitch Brianishnikov, Soviet special envoy has handed over the oil installations of the Hajibeau oasis in the Khuryan wastelands to Fathollah Naficy, director of the Iranian National Oil Co.

The two wells—one dry hole, the other producing sulphurous gases—together with three shacks, a wooden derrick and a radio transmitter—had been manned by four Russians and two police dogs since 1926, when the Iran-Soviet agreement was concluded.

Indian Government to Explore

The Oil and Natural Gas Commission, under the chairmanship of Mr. K. D. Malaviya, minister for natural resources has decided to go ahead with exploration work in Jwalamukhi, Jaisalmer, Cambay and Kutch. The commission plans to employ foreign personnel in various projects to import equipment from countries offering suitable terms.

Under the Second Five-Year Plan, Rs 40 to 50 crores ($84-105 million) are to be allocated for refineries, pipe lines and other equipment while Rs 30 crores ($63 million) will be allocated for drilling and exploration works.

Drilling operation will start in Jwalamukhi, but one is not likely to begin before November due to road damage from heavy rains.

Pakistan Petroleum Ltd., a subsidiary of Burmah Oil Co., is drilling an exploratory well on Drigh Road near the main street of Karachi, which runs from the capitol building to the airport. The well is shown rigging up above. It is about three miles from the center of the city.

Road Tests in Switzerland

A fleet of 24 cars, representing all the major European makes, is being used to carry out road tests in Switzerland under the supervision of British Petroleum's Sunbury Research Station. These tests follow other tests already carried out in Algeria and Sweden, with a view to assessing the performance of motor spirits under actual driving conditions, in various climates. The location chosen for the Swiss test is the Susten Pass, which connects Meiriugen with Wassen, and at its highest point is about 7,460 feet above sea level.

Kuwait Crude Exports

Exports of crude oil from Kuwait came to 35,688,223 barrels during July, 1956, and 244,429,599 for the first seven months of the year. Kuwait Oil Co. is the company in the area.

Distillate exports came to nothing in July and 516,505 barrels during the first seven months.

Major destinations of the crude, by country, for July and the first seven months were:

	July	*Year*
U.S.A.	7,172,227 Bbls.	33,822,808 Bbls.
United Kingdom	9,608,717 "	74,712,841 "
France	4,623,316 "	33,407,521 "
Holland	3,315,128 "	23,514,929 "
Aden	2,441,241 "	19,016,742 "
Italy	2,243,971 "	17,596,502 "
Australia	963,092 "	10,965,752 "
Brazil	573,908 "	6,261,954 "
Argentina	995,182 "	6,236,451 "
Belgium	— "	2,779,563 "
Canary Isles	796,269 "	2,606,048 "
India	623,119 "	3,395,522 "
Other	2,332,058 "	10,112,966 "
Total	35,688,223 "	244,429,599 "

The U.S. take of crude from Kuwait set a new monthly record in July. The U.S. share from the Neutral Zone, 487,442 barrels—was the highest for any month this year.

Neutral Zone exports of crude came to 324,104 barrels during July, and 3,184,439 for the first seven months. These are Aminoil exports.

Destinations were, for the first seven months, U.S.A., 243,971 barrels; Japan, 1,855,056 barrels; and Italy 1,085,412 barrels. Only exports in July were to Japan, 324,104 barrels. All were by Aminoil.

Getty Oil Co. crude exports came to 770,977 barrels in July, and 3,249,023 for the first seven months. Destinations, for seven months, were U.S.A., 1,584,383 barrels; Japan, 545,779 barrels; and France, 1,118,861 barrels.

Zanzibar Well

The first oil well on the island of Zanzibar, off the coast of East Africa, is being drilled jointly by The British Petroleum Co. and the Royal Dutch/Shell Group. The well is expected to be drilled to about 12,000 feet. It is the second deep test well sunk in East Africa since exploration started in the area in 1951. The first, on Mafia Island, was completed dry early this year at 11,051 feet.

Materials that will be used during the operation include: 200,000 gallons of fuel, 700 tons of cement, 24,000 feet of casing, 1,500 tons of mud chemicals, 10,000,000 gallons of water and 600,000 kwh of electricity. A special jetty had to be built where all necessary equipment could be brought by ship and unloaded. Roads were built to the drilling site, and houses have been erected for 300 workers.

Drilexco Promotions

Dr. William A. Gorman, exploration geologist; George I. McFerron, chief geologist, and E. A. Roberts, Jr., production manager and coordinator of the engineering, producing and purchasing departments of Drilling & Exploration Co., Inc. have all been promoted to the post of vice president.

Indian Refinery Profits Scrutinized

Profits on refining operations in India are likely to undergo examination in the near future, according to the Minister for Works, Housing and Supply, Mr. Swaran Singh. He said in Lik Sabha on August 10, that government would take such steps as might be appropriate from time to time to see that there was no avoidable drain from this country of any undue profits that might be made by the sale of the oil refinery products.

After a year's operation, the Stanvac and Burmah-Shell Refineries reported that their returns had not been excessive and government is scrutinizing this claim. The Minister stated he was confident that in case of more than reasonable profits, the refineries would adjust their retail prices.

The Indian government announced some months ago that it would require a majority share in any new refineries building. This does not affect refineries already in the country.

Exploration in New Zealand

British Petroleum Co. has formed a new company known as BP (Oil Exploration) Co. of New Zealand which will supervise B.P.'s exploration activities there. Arrangements have been made with Todd Bros. who along with B.P. hold prospecting licenses, for a program of exploration on the East Coast of the North Island covering the districts of Hawkes Bay, Gisborne and Wairarapa. Initial finance for the program is £500,000 ($1,400,000).

B.P. took part as far back as 1927 in the search for oil in New Zealand and last year B.P. and Todd Bros. made an arrangement to form a company known as Shell D'Arcy and Todd Services, Ltd., for exploration in the Taranaki and Rangitiki districts. For many years a small production of high grade crude has been obtained at Taranaki.

Further Exploration in Sicily

British Petroleum Co. has begun a seismic survey in southeast Sicily, which follows other intensive geophysical and geological surveys already made on the company's concessions on the island. B.P.'s first well was drilled near Vittoria in 1953/54, and some crude oil was found, but it was of very low value.

To Drill in India

Standard Vacuum Oil Co. will drill its first test well in West Bengal Basin of India early in 1957, according to K. D. Malaviya, minister for natural resources and scientific development. It was recently announced that the government of India is to establish shortly a special organization at Calcutta for liaison between the government and companies engaged in oil exploration. The aim is to implement government decreasing petroleum prospecting. To further its own work, the government of India has launched a program to train 120 apprentice geologists and geophysicists starting August 26. Minister Malaviya said this is unconventional, opposed by oil experts, and expensive, but that India's oil exploration should not be postponed.

Ketjen's new 25 ton tankcar for the transportation of fluid cracking catalyst Ketjencat in bulk, can be unloaded directly into the hopper at the rate of one ton per minute without mechanical losses.

Iran Consortium Payments

The oil consortium companies have paid Iran a total of $183,011,320 in about two years in oil revenues.

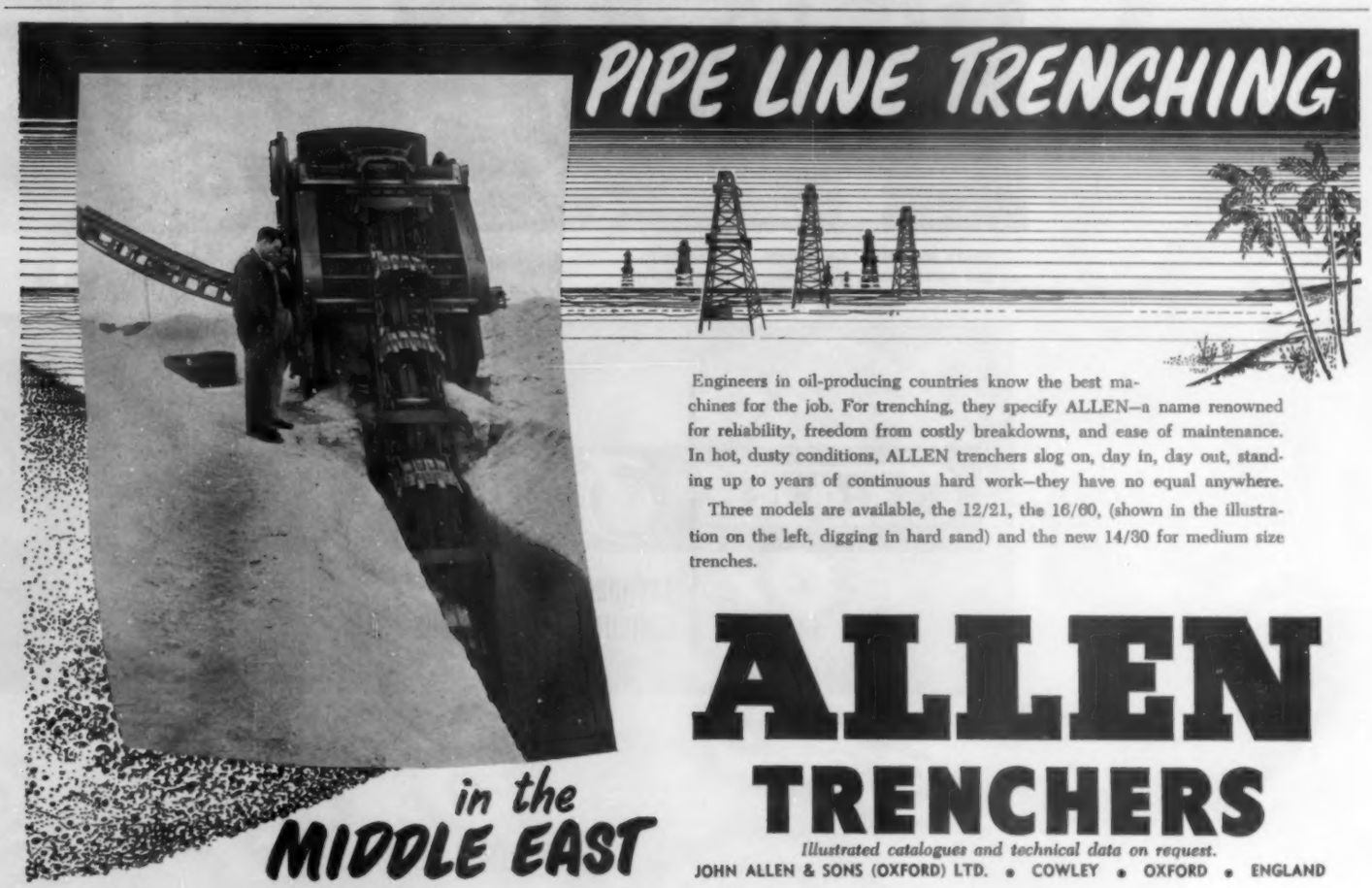
The payments cover the period Oct. 29, 1954, when oil operations were resumed under a new setup, to Aug. 1, 1956. The payments total represents income tax to the government of $130,436,096, and stated payments of $52,575,224.

During June and July the payments made came to $27,563,530.40. This was made up of taxes of $19,730,765.60 to the government, and payments in cash and in kind to the National Iranian Oil Co. The NIOC received no payments in June. In July, it received $6,369,160 in cash and $1,463,604.80 in kind.

French Oil Nationalization

M. Pierre Poujade has called for the nationalization of British and American oil companies in France. He said that since many Americans and British think it legitimate for Egypt to nationalize the Suez Canal, "France should nationalize her oil installations."

(*Continued on page* 132)



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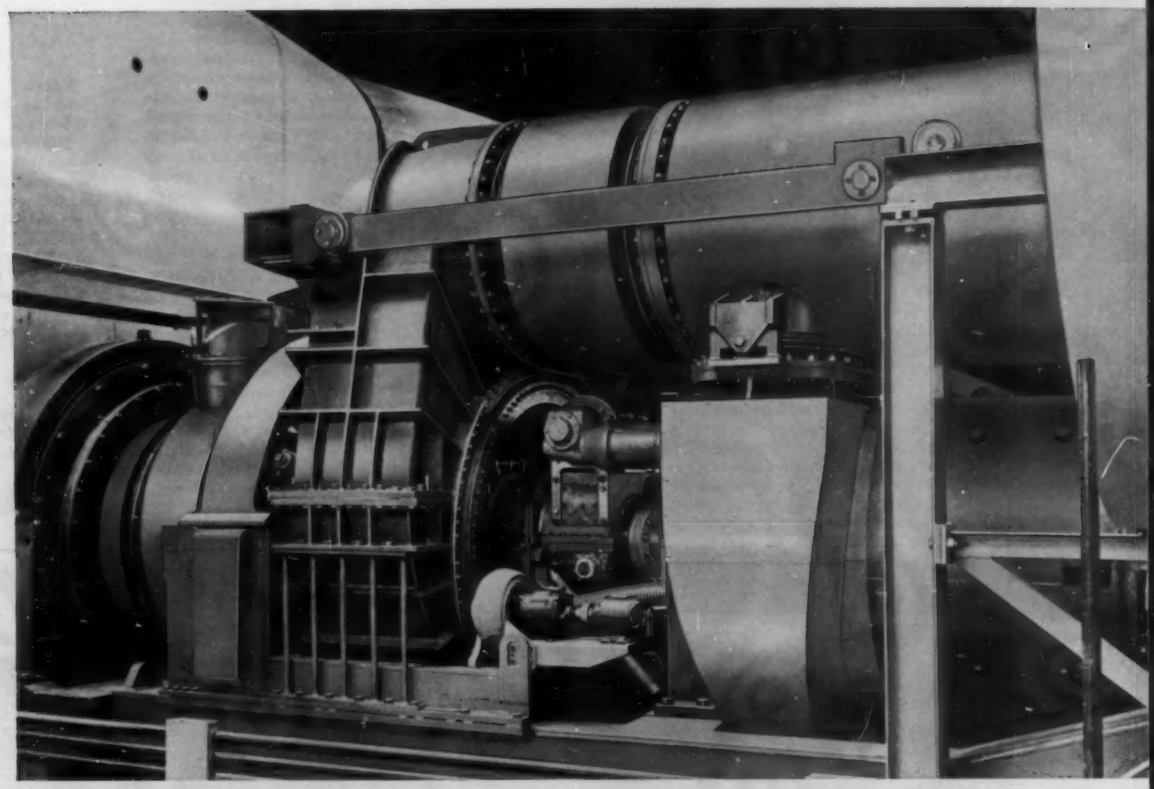

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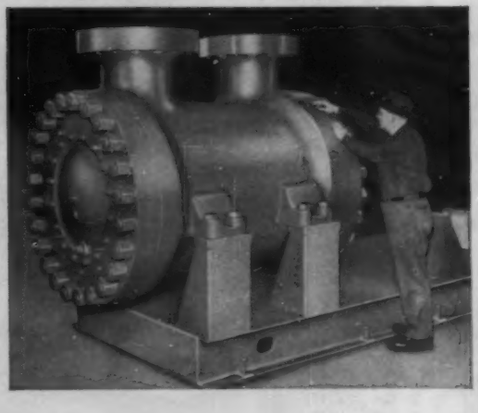

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*Other models, incorporating thallium-activated, 4½" diameter, 2" thick sodium iodide crystals with either mosaic or single crystal construction, available at additional cost.

International News and Notes

(*Continued from page 129*)

New Storage Facilities at Dakar

Two new storage and servicing facilities have been completed at Dakar, French West Africa. A new petroleum wharf 260 meters long and 28 wide, has been completed at a cost of 250 million francs. It has flat upper platforms and galleries below for carrying pipe lines belonging to five companies. Water is 12 meters deep at the dock. Four small or medium tankers can be handled at the same time.

Inland is the new ocean terminal storage project of Mobiloil A. O. F. company. It has 10 storage tanks with a total capacity (in U.S. barrels) as follows:

Motor gasoline	65,856
Kerosine	26,166
Gas oil	31,828
Avgas 100/130	24,908
Avgas 108/135	15,914
Avgas 115/145	8,932
Total	173,604

Development of Assam Oil

The drilling of Nahorkatiya Well No. 18 set a new speed record in Assam, when it was drilled in as a producer at 10,400 feet within 24 days. The previous record was No. 16 which was drilled in 26 days. Well No. 19 is now drilling. Preliminary plans are now under consideration for the full scale development of the oil areas recently found in Assam. The proposals being studied by the government of India and the Burmah Oil Co., Ltd. include the setting up of at least two new rupee companies, one to deal with exploration and production and the other with refining and the transportation of crude from the fields to a proposed new refinery.

Present knowledge indicates that the new fields will be capable of an output of two million tons per year (40,000 b/d) for at least 20 years.

Swedish Shipbuilding

K. B. Jacobson, managing director of the Gotavarken Shipyard, Gothenburg, Sweden has announced that one of the building ways of this yard will be enlarged to allow the building of ships up to 60,000 dwt, and that at the daughter company, i.e. Oresundsvarvet of Landskrona, Sweden, where there is more space available, one of the berths will be rebuilt in order to accommodate the building of ships up to about 80,000 dwt.

The Gotavarken Shipyard also announces that the motor tanker "Marieborg" of 19,500 dwt built by them to the order of Rederi A/B Ragne, Vastervik, Sweden, was succesfully launched on Aug. 7, 1956.

Her principal dimensions are: length overall, 557 feet; breadth molded, 71 feet; depth to Shelter deck, 40 feet 8 inches; draft, 30 feet 3 inches; speed loaded, 15.25 knots. She is fitted with a single-acting, two-stroke Gotavarken diesel engine equipped for the burning of bunker oil.

Consumption Up 10% in Rhodesia

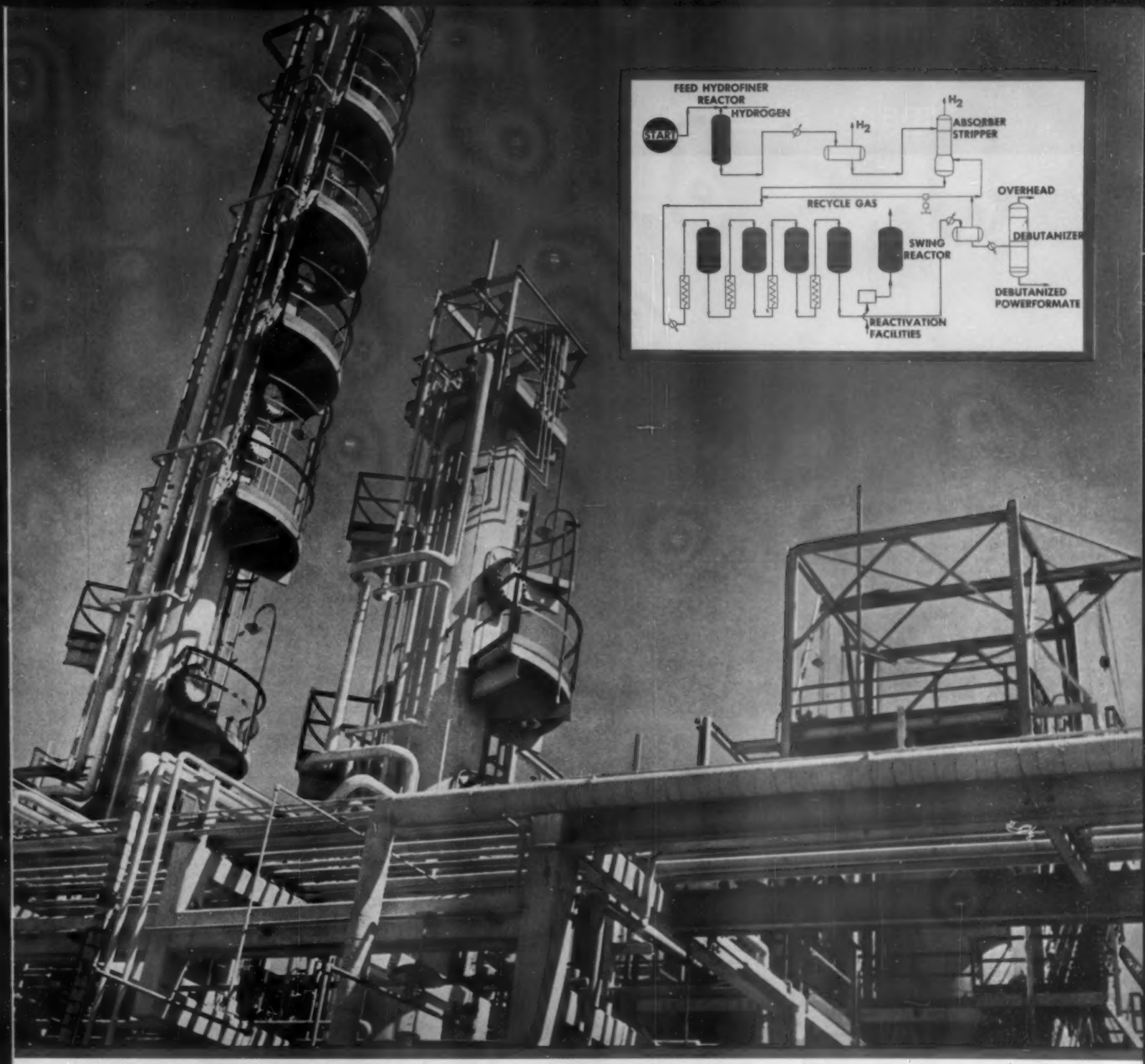
Consumption of petroleum products in Rhodesia climbed more than 10% in 1955 over the year before, according to figures supplied by the Shell Co. of Rhodesia, Ltd. The consumption, which came to 351,000 tons (7,020 b/d) was more than five times that of 1939. Diesel fuel increased most in 1955, by about 26%.

CONSUMPTION IN RHODESIA
(Long tons)

	1939	*1954*	*1955*
Gasoline	34,000	161,000	179,000
Aviation gasoline	1,000	14,000	15,000
Power kerosine	1,000	22,000	20,000
Illuminating kerosine	3,000	15,000	17,000
Gas and fuel oils	13,000	62,000	78,000
Lubricants	4,000	15,000	17,000
Other products	8,000	29,000	25,000
Total	64,000	318,000	351,000

Turbodrill Directional Drilling Control

Russia has declared its willingness to supply Austria with three devices, used in connection with turbodrills for directional drilling. The devices are to be used with the TS-3 turbodrills which the Soviets turned over to the Austrian Oil Administration upon leaving the oil fields.



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Oil Company Staff Changes

Rear Admiral Carl G. Drescher

REAR ADMIRAL CARL G. DRESCHER, former director of the Armed Services Petroleum Purchasing Agency, has been appointed assistant director of foreign operations of Sinclair Oil Corp. A graduate of the U.S. Naval Academy and the Harvard Business School, Admiral Drescher served for a number of years in various petroleum posts with the Navy. In 1948, in the organization of ASPPA to consolidate all petroleum procurement and distribution for the Army, Navy and Air Force, he became that agency's first director. With service rotation of the directorship, he returned to ASPPA again in 1955. In his new position with Sinclair, Admiral Drescher will assist in directing Sinclair's foreign operations of exploration, production, supply and distribution in both the Western and Eastern Hemispheres. His headquarters will be in New York City.

MORGAN J. DAVIS has been named executive vice-president of Humble Oil & Refining Co. Mr. Davis is being replaced as vice-president and director in charge of exploration by Ed. J. Hamner. Dick H. Gregg, a member of Humble's legal staff since 1938, has been made associate general counsel.

ERIC G. LINDROTH has been elected a director and senior vice president of Esso Export Corp. He also was appointed to the Esso Export executive committee. Mr. Lindroth began work for the Jersey Standard organization as an office boy in 1932. He became assistant treasurer of Esso Export Corp. in 1944, and chairman of the board of Esso Export Ltd. and Standard Oil International Ltd., in 1954.

W. C. Lane

W. C. LANE has been appointed manager of Standard Oil Co. of California's foreign trade department, succeeding J. E. Black, who has retired. Mr. Lane has been with Standard for nearly 30 years. He joined the company as a service station salesman and at one time headed the company's New York office. Mr. Black, who served nearly 45 years with Standard before retiring, was appointed manager of the foreign trade department in 1931.

ROGER D. STANWOOD has been elected a vice president of Transcontinental Gas Pipe Line Corp., as announced by Tom P. Walker, president of the company. Mr. Stanwood will continue to direct the company's gas supply department.

DEWEY E. WILLIAMS, has been named superintendent of land and inland barge operations of the Louisiana division of Loffland Brothers Co., Tulsa. He began his career in the oil well drilling industry in 1941 when he joined Loffland Brothers. He will be headquartered in New Iberia, La.

J. H. LONDON has been elected a member of the board of Shell Oil Co. Mr. London has served with various affiliated and associated companies throughout the world, and is now general managing director of Royal Dutch Petroleum Co. and chairman of Shell Caribbean Petroleum Co. He replaces Dr. H. Bloemgarten on the Shell Oil board. Mr. Bloemgarten, who has retired, served as a vice president of Shell Oil Co. prior to 1947 when he became a director of the company and a managing director of Royal Dutch Petroleum Co.

Ben Weil

BEN WEIL has been appointed advertising manager of Magnet Cove Barium Corp. Mr. Weil has had many years experience in oil industry advertising, both as an advertising manager and account executive.

PAUL A. BEST has been appointed president of California Crude Sales Co., subsidiary of Standard Oil Co. of California which markets crude oils outside the United States. Mr. Best, previously vice president of the company and headquartered in Perth Amboy, N. J., succeeds J. E. Black, who has retired. The new president will make his headquarters in San Francisco.

A native of Dracut, Massachusetts, Mr. Best is a graduate of the University of Florida and joined Standard organization in 1949 as a special representative of The California Oil Co., Standard's East Coast refining and marketing subsidiary. As head of California Crude Sales, he will have charge of sales of foreign crude oils produced by subsidiary and affiliated companies of Standard.

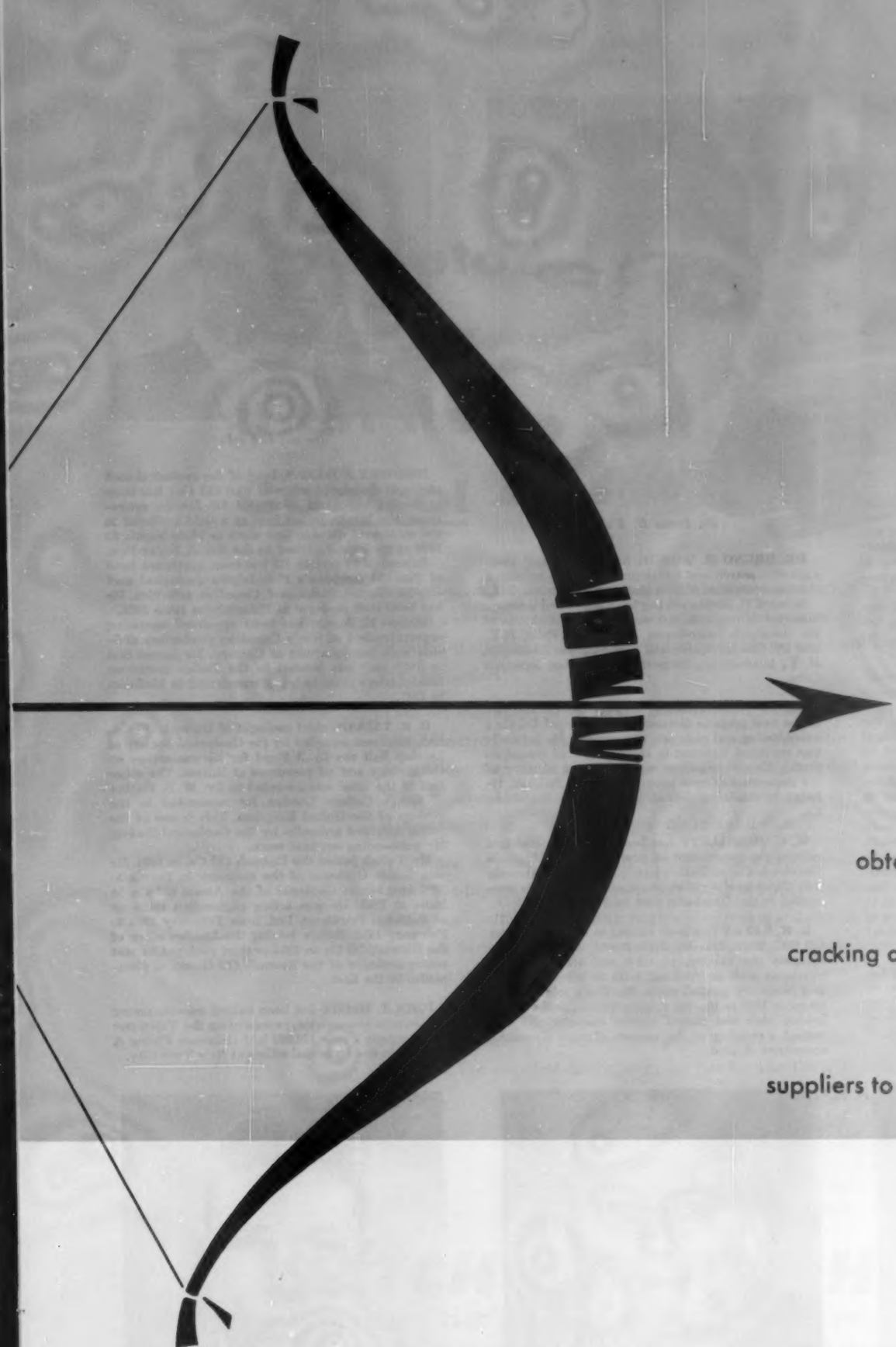
FRANK P. BRUNETTA has been appointed supervisor of costs and statistics in the eastern division marketing department of Tidewater Oil Co. Mr. Brunetta, whose headquarters are located in the divisional office in New York City, was formerly associated with Olin Mathieson Chemical Corp.

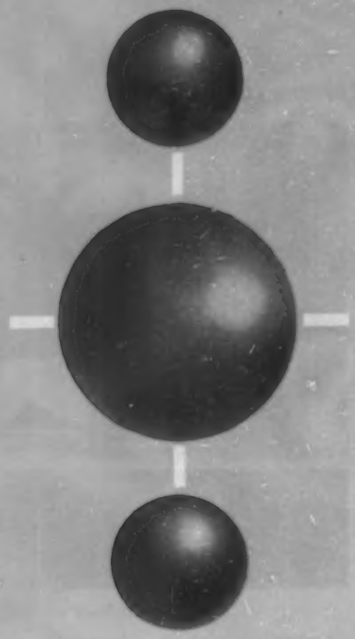
JOHN F. DALEY of the Du Pont Co., has been promoted to vice president, director and member of the executive committee. Mr. Daley is a director of the American Petroleum Institute, and as former general manager of the Organic Chemicals Department was responsible for the manufacture and sale of tetraethyl lead.

Eric G. Lindroth

J. H. London

John F. Daley





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Lewis W. MacNaughton

LEWIS W. MACNAUGHTON has been elected chairman of Isotopes, Inc., Westwood, N.J. Mr. MacNaughton is a partner in the firm of DeGolyer and MacNaughton, consulting geologists and geophysicists. Isotopes, Inc., is beginning its second year in study of the practical utilization of radioactive materials.

Mr. MacNaughton is currently a director of Pennroad Corp., Republic National Bank of Dallas, Republic Natural Gas Co., Trunkline Gas Co., and The San Juan Oil Co.

C. J. BITZER will head the new chemical products section of the marketing coordination department of Standard Oil Co. (N.J.).

Mr. Bitzer formerly was sales manager of the alcohols and chemicals division of an Esso Standard marketing affiliate. In his new position he will be in charge of world-wide market development work in petrochemicals for the parent organization. After obtaining his degree in chemical engineering at Massachusetts Institute of Technology, Mr. Bitzer joined Esso Standard in 1928 in process control work at its Bayonne refinery in New Jersey. Through assignments in technical service and catalytic cracking operations, he advanced to chemical products manufacturing in 1944 and subsequently became assistant manager of East Coast operations in charge of chemical products. Following 10 years of manufacturing experience, Mr. Bitzer was transferred to his sales post in New York in 1954.

B. SMITH has joined Refinery Construction Co. of Houston, Texas and Buenos Aires, Argentina as vice president in charge of sales. Mr. Smith has been in the refining industry for 23 years, the last nine as superintendent of Republic Oil and Refining Co. of Texas City, Texas.

Dr. Bruno H. Wojcik

DR. BRUNO H. WOJCIK has been named manager of research and development for the industrial chemicals division of Olin Mathieson Chemical Corp.

Bernard H. Nicolaisen has been appointed assistant manager of research and development in charge of the division's laboratories at Niagara Falls, N.Y., and Dr. Chester White will supervise the Rochester, N. Y., laboratories, formerly the Genesee Research Corp.

JAMES W. BATEMAN has been named director of the new projects division in Continental Oil Co.'s coordinating and planning department. He formerly was technical assistant to the manager of manufacturing. Dan H. Sanders was appointed director of the department's new progress reports division. He formerly was controller of Middle States Petroleum Co.

W. G. MOROARTY has been appointed assistant general superintendent of production for Magnolia Petroleum Co. at Dallas, headquarters. He formerly was Oklahoma division superintendent. He is succeeded in the Oklahoma post by H. K. Holland.

R. K. KELLY has been named to head Tidewater Oil Co.'s transportation department, which will encompass the marine, pipeline and traffic departments, as well as trucking, bulk terminal planning and inventory control units. Mr. Kelly joined Tidewater in 1929 as marine superintendent and the following year was named marine manager. He was named a member of the eastern division operating committee in 1944.

Herbert J. Weeks

HERBERT J. WEEKS, head of the geological staff at the Philadelphia office of Sun Oil Co., has been appointed geological counselor for foreign operations. Mr. Weeks joined Sun as a field geologist in the southwest division and went to Philadelphia in 1930 as geological advisor to the late J. Edgar Pew.

Samuel M. Vauclain III has been appointed head of Sun Oil company's Philadelphia geological staff for the United States and Canadian activities. He has been staff geologist at Philadelphia since 1952.

Merton E. Austin has been appointed operating superintendent of Sun's Canadian production division with headquarters at Calgary. He joined Sun in 1940 and was located in the Dallas southwest headquarters prior to being transferred to Michigan in 1947.

H. R. TAINSH, chief geologist of Burmah Oil Co., Ltd., has been awarded by the Geological Society of London half the Lyell Fund for his researches on the geology and oil resources of Burma. The other half of the fund was awarded to Dr. W. S. Pitcher of King's College London for researches in the geology of the United Kingdom. This is one of the prizes awarded annually by the Geological Society for outstanding original work.

Mr. Tainsh joined the Burmah Oil Co. in 1934. He was Senior Geologist of the company in Burma in 1946 and Senior Geologist of the Assam Oil Co. in India in 1948. He was acting exploration manager of Pakistan Petroleum Ltd. from February 1952 to February 1953. Before joining the London office of the Burmah Oil Co. in 1954 as chief geologist he was senior geologist of the Burmah Oil Group of Companies in the East.

JOHN T. McCOY has been named manufacturing department coordinator, representing the Tidewater Oil Company's new 130,000 b/d Delaware Flying A refinery in the divisional offices at New York City.

B. Smith

R. K. Kelly

John T. McCoy

No motor is safer than its Control

In a split-second, current overload can paralyze your production by burning out a key electric motor. Whether your business is large or small, an unexpected stoppage costs money in lost production, lost man-hours—even lost orders!

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London Letter

By E. Lawson Lomax

In mid-September the British Road Federation held a conference in London on the subject of urban motorways. In one of the papers given by Arthur S. Hodgkiss, assistant general manager of the Triborough Bridge and Tunnel Authority, New York, emphasized the fact that traffic congestion in the United Kingdom is greater than in the United States, an average of 23 vehicles to the mile in the United Kinkdom against 17.3 in the United States. The accidents were fewer on super highways in the U.S. than on other roads and fuel consumption was reduced. A country like the United Kingdom which has heavy motor transport can not afford to have an inadequate highway system.

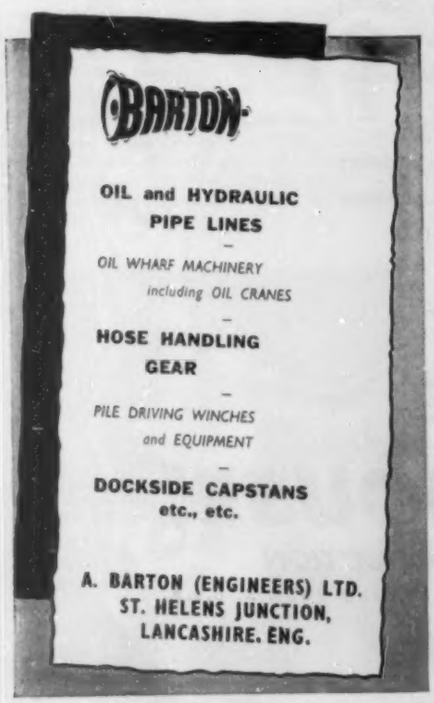
The conference adopted a resolution calling on His Majesty's Government to take steps to build those motorways which have already been planned and authorized and to build further urban motorways in the shortest possible time.

Record Additions To Pipe Lines

The fast-growing oil pipe line network in Canada added up to 5,069 miles of line at the start of this year. This is up from 4,656 miles a year earlier. Another 1,514 miles of oil pipe line in the U.S. are devoted to carrying of Canadian crude oil. More lines are being built.

The total of oil delivered, mostly crude oil, came to 224,274,768 barrels during 1955, up 30% from the 172,495,935 barrels the year before. This represents deliveries through oil lines in Canada.

The Canadian natural gas network came to 4,143 miles at the start of this year, and there were 5,538 miles more of distribution lines. As in the past, greatest mileage was in Ontario, followed by Alberta and Saskatchewan. New Brunswick was unchanged. British Columbia has a modest mileage. Natural gas pipe line expenditures during 1955 consisted of $22 million for gathering and transmission lines and $22 million for distribution lines during 1955. This represented an increase of 50% over the total of $28 million spent the year before for both types of lines.



Corrosion Problem Solved

The British Petroleum Co. has been carrying out research to eliminate low temperature corrosion in air heaters or economizers resulting from sulfuric acid. These have been successful and an inexpensive corrosion inhibition process has been developed using ammonia as a neutralizing agent.

Developments at Milford Haven, Pembrokeshire

Milford Haven, situated at the southwest corner of Wales, has long been known as one of the best deep water harbors in the U. K. It is, however, not very conveniently situated for industry and its development has been slow. Recently, however, it has been brought into the picture as a possible oil harbor.

Some months ago Esso Petroleum Co. Ltd., purchased some hundreds of acres in the vicinity, suitable for a storage depot or a refinery. British Petroleum Co., Ltd., also has purchased a large site at Popton Point, on the south shore of Milford Haven, on which it is planning to build a berthing and discharge facilities for very large tankers, the project being called "Angle Bay" project. The new terminal will be equipped with two berths, and storage tanks, and will be connected with the Llandaroy refinery by a 60-mile 16-inch or 18-inch pipe line, having a crude capacity of (100,000 b/d). The project, which will take three years to complete, is estimated to cost about £5 million.

Another project at Milford Haven, is that of the Milford Haven Development Co. which has proposed the building of oil docks with berths capable of taking the largest oil tankers at present contemplated together with a dry dock large enough to accommodate them for repairs. The estimated cost of this scheme is between £13 and £15 million. Efforts are being made to interest major oil companies in this scheme.

U. K. Refining Capacity Expansion

The Shell Petroleum Co. Ltd. will increase the capacity of its Shell Haven refinery by the addition of a crude distillation unit of 80,000 b/d capacity at a cost with ancillary equipment of about £6.5 million. The plant will be built by E. B. Badger & Sons, Ltd.

A special side-cut naphtha for Platforming will be taken off in addition to other light products and fuel will be produced as a bottom product. Completion is planned for the end of 1958, when capacity of refinery will be 155,000 b/d.

B.P.'s Kent Refinery

A £26 million expansion scheme is now well in hand at British Petroleum Company's Kent refinery. Foundation work has started on all units, and piling completed for tankage. Sand filling for low lying areas is being dredged from the river Medway, some 450,000 cubic yards have been transferred to location.

New Oil Installation at King's Lynn, Norfolk

In connection with Shell-Mex and B.P.'s £10 million reconstruction program to streamline the company's distribution network, a further step has been taken with the opening of a new depot at King's Lynn, Norfolk. This installation will replace eleven older distribution points in East Anglia and will be supplied direct by sea with products from Shell's and B.P.'s refineries in the Thames Estuary.

Seismograph Service, Ltd.

The S. S. "Seislem," the only British ship fitted out specifically for geophysical exploration at sea, is now back in England for a major marine refit after extended operations in the Far East, Africa and the Mediterranean. Opportunity is being taken to modify and improve the seismic technique and to install a magnetic recording unit. After trials of the new additions at sea, the vessel will proceed to the Mediterranean for further operations.

Effect of Suez Studied

Students of supply lines from the Middle East to Europe have concluded that a shut-down of oil traffic through Suez would require the importation of 200,000 to 300,000 b/d of Latin American crude or the use of the long route around the Cape for that much oil. The remaining European supply could be provided by existing pipe lines now delivering oil to Mediterranean ports. Increases in capacity of these lines by installation of new pumping facilities would be required. These increases could be made quickly.

About 75% of Iraq's oil production would not be affected by the ultimate closure of the Suez Canal and up to about 50% of Saudi Arabia's production also could be exported without Canal transit, so these two countries are in a strong position and could exert strong pressure on Egypt.

Provision for natural increases in European consumption would have to be made through the building of additional pipe lines. Iraq Petroleum Co. now is building a new big-inch line which will have a capacity 180,000 b/d. Terminal of this line is to be at Banias. Original plan was to end the line at Tripoli but IPC was unable to conclude a satisfactory agreement with the Lebanese Government regarding payments for transit right. Lebanon thus appears to have lost revenues totaling £750,000 yearly. Iraq Petroleum Corp. also has found it necessary to reduce its roster of employees in Lebanon. A considerable number had been retained although work was lacking. This was done with the thought that the personnel would be needed when the new line was extended to Tripoli. Since this is not to be it was necessary to release the men.

The calculations discussed above are based on the theory that Iran and Saudi Arabia would not force a shut down of production in support of Egypt's position. It is assumed that the two major producing countries would not go so far as to reduce their countries to a state of economic chaos to support a sister Arab nation.

The Trinidad Oil Co., Ltd.

The Trinidad Oil Co., Ltd., has announced that Lord Baillieu, Robert Walker and T. Muir Warden have resigned as directors and that R. H. Aitken, A. W. Baucum and K. O. G. Huntley have succeeded them.

Dr. A. W. Pearce, assistant manager at Fawley Refinery of Esso Petroleum Co., Ltd., has been appointed general manager of refining. Dr. Pearce is 35 and holds the degrees of B.Sc. and Ph.D. in Chemical Engineering, Birmingham University. He joined the company in 1945. He was in charge of the start up of all new refinery equipment from 1951 when the refinery came on stream until 1954.

Petroleum Consumption Up 8.1%

The Petroleum Information Bureau reports consumption of petroleum products in the U. K. for the first six months of 1956 at 12,639,146 tons as against 11,689,632 tons for the first six months of 1955, an increase of 8.1%. Motor gasoline increased 3.1%, the total sales of premier grade motor spirits now exceeds those of standard grades by a small margin, less standard grade spirit is being used in commercial vehicles, with increasing use of diesel vehicles.

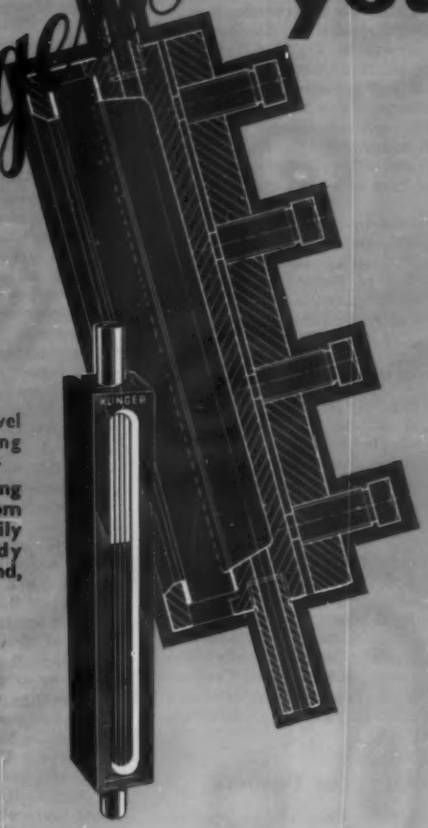
The major increase is in fuel oil, with a consumption for the half year of 3,337,470 tons. This is due to the fact that fuel oil, which is more reliable in quality and delivery is gradually replacing coal in many industries, and all things considered it is less expensive to use fuel oil than coal, once the oil burning and handling plant is installed.

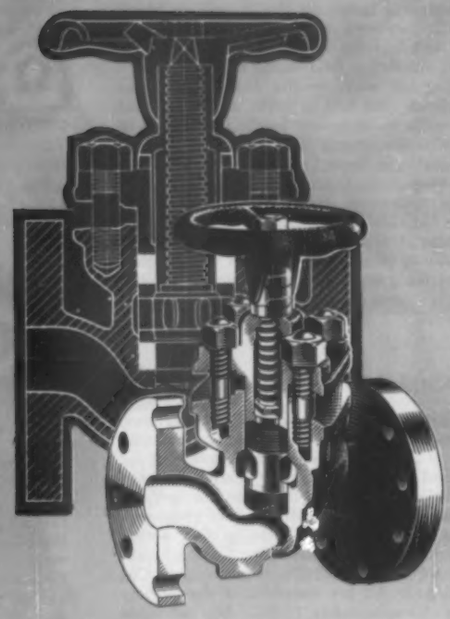
Tanker News

The Niarchos group has placed an order with the Bethlehem Steel Co., Quincy, Mass., for the building of a 65,000 dwt oil tanker. The same company has two 65,000 dwt tankers on order in Germany, and one of 46,000 dwt on order from Bethlehem.

Hawthorne Leslie, Ltd. launched the 32,300 dwt S.S. turbine tanker "Volvatella," for Shell Tankers Ltd., at Hebburn-on-Tyne on Sept. 5. Sponsor for the launching was Mrs. J. H. London, wife of a managing director of the Royal Dutch/Shell Group.

Klingerise your plant





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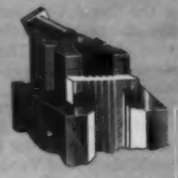

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The Klinger Seatless Piston Valve operates on an entirely different principle from the usual type of seating valve. It consists basically of a finely ground piston, operated by the valve spindle and hand wheel, and moving through two or three non-metallic resilient valve rings, capable of resisting steam, oil and most fluids at high temperatures and pressures, and separated by a ported lantern bush. It is made in a great variety of sizes and designs, to suit all purposes, and has the following advantages:—

No seat—consequently no regrinding. Can be serviced in the line. Unaffected by wiredrawing. Unaffected by throttled use.

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Latin American Oil News

(*Continued from page 8*)

Talon Petroleum Acquired by Venezuelan Petroleum

Venezuela Syndicate has acquired all assets of Talon Petroleum, C. A., according to Cecil V. Hagen, president of Venezuela Syndicate and of Talon Petroleum. A controlling interest in Venezuela Syndicate, which is listed on the American Stock Exchange, was acquired a year ago by Clint W. Murchison, Cecil V. Hagen and Roy B. Kelly.

A complete operating field camp for oil production, producing oil wells in the Maracaibo Basin (averaging about 2,500 b/d in 1956) and a pipeline from these wells to deep-sea loading facilities in Lake Maracaibo are among the assets acquired by Venezuela Syndicate from Talon. "In addition, we have taken over from Talon Petroleum bids they have already submitted for new oil exploration concession in the Lake Maracaibo area. We consider that exploration of new acreage is just as important to our company as efficient operation of our producing wells, and we intend to explore intensively and immediately all new concessions granted to us," Mr. Hagen said.

SEG To Establish Venezuelan Section

Formation of the Venezuelan Geophysical Assoc. (Assoc. Venezolona Geofisica) has been announced in Caracas by C. G. Schauble, chief seismologist for Sinclair Oil and Gas Co. and acting secretary of the association. Other temporary officers of the new organization are Clifford A. Wachter, chief geophysicist for Venezuelan Atlantic Refining Co., acting legal representative and Joseph A. Keeling, geophysical supervisor for Phillips Petroleum Co., program chairman. All are members of the Society of Exploration Geophysicists (SEG). Mr. Schauble said the fifty-one charter members hope to become a local section of SEG as soon as the bylaws have been registered in accordance with Venezuelan law.

Colin Campbell, business manager, announced at SEG headquarters in Tulsa, that three other local sections are being formed in the Salt Lake City area, Edmonton, Alberta, Regina, Saskatchewan.

Cuban Regulations on Premium Gasoline Sales

Cuba has suspended a regulation allowing sales of premium gasoline, but plans to issue another, it is reported.

The suspension came after protests from industry that the margin for the dealer should be larger for premium than regular. This, it was explained, would give him an incentive to push premium gasoline sales. First order allowed the same actual margin for premium and regular.

Costa Rican Well Test

Union Oil Co. of California's Cocolas 2 well flowed 1,700 barrels on a seven hour test (5,800 b/d) near here Sept. 12th. Near the end of the test, which was at 4,945 feet, salt water was encountered. Tests will continue, according to Mr. Joel Lloyd, general manager of Union's local subsidiary, Compania Petrolera de Costa Rica, S. A.

Tubing pressure was 500 lbs. and casing 700 lbs., choke 30/64. Pressure was described as excellent by officials.

Cocolas 2 well, considered a commercial producer by officials here, will be the first in Central America and Panama. Encouraging shows had been obtained from Cocolas 1 well, a kilometer from here. However, the well was shut down on advice from Union's geologists and drilling was started on the present site. The location is approximately 35 kilometers from this Caribbean port village and within a kilometer of the Panama border in a dense jungle area.

Union officials announced plans to start drilling on the Panama side of the border immediately. Union holds exclusive exploration and exploitation rights from Costa Rica and Panama on both sides of the border in this area.

Texaco Completes Trinidad Oil Purchase

The Texas Co. has acquired more than 95% of the outstanding capital stock of the Trinidad Oil Co., Ltd. This is a sufficient amount to complete acquisition of the Trinidad Co. in accordance with Texaco's purchase offer. Trinidad Oil Co. has substantial holdings of acreage in Trinidad, and currently produces crude oil at the rate of 25,000 b/d. On the Island, it owns and operates a modern and complete 80,000 b/d refinery, and has port facilities at Pointe-a-Pierre. Through subsidiaries and affiliates, it markets in Trinidad, Jamaica, Puerto Rico, Dominican Republic, and other Caribbean Islands, and operates a tanker fleet of owned and chartered vessels.

Through a 50% interest in Regent Oil Co., Ltd., Trinidad markets petroleum products extensively throughout the United Kingdom and Eire. It also owns approximately 90% of Regent Refining Co., Ltd. of Canada, which has marketing operations in Canada and a refinery at Port Credit, near Toronto.

New Concession in Panama

Cataract Mining Corp. of New York has announced acquisition of oil and gas concessions of two million acres for exploration in Panama. The Union Oil Co. of California recently brought in its first major oil well in the adjoining Republic of Costa Rica, and began drilling in Panama.

The greater part of the Cataract concession is located in the Province of Chiriqui in Panama, alongside the Costa Rican border, and near the new Union field. Cataract will begin drilling operations in October. At least 15 oil companies are said to be presently seeking, or have acquired concessions in the Republic of Panama. Cataract's concessions were acquired by Compania Catarata de Petroleo Panama, S.A., wholly owned subsidiary of Cataract Mining Corp. of New York. This company produces oil and gas in Texas, Canada, and Latin America, according to the company.

To Begin Drilling in Panama

International Oil and Metals Corp. of Los Angeles, has announced the company will begin a core drilling program in Panama soon under an agreement between International and Compania Petrolera Del Golfo Del Darien, an affiliate of Commerce Corp. of New York. The agreement covers approximately 10 million acres in southeastern Panama, bordering on Columbia, including a large offshore portion of the Gulf of Darien, and all of Darien province, according to Commerce Corp.

Brazilian Refinery Inauguration

The new petroleum refinery near Manaus, Brazil, on stream this summer, is to be inaugurated in December.

The plant, with 5,000 b/d capacity, is the first in the Amazon Basin.

Design was done by Southwestern Engineering Co., Los Angeles.

Isaac Benayon Sabba is president of the company operating the plant, Amazon Petroleum Co.

Capital stock of Cr. 100,000,000 and capital loan of Cr. 150,000,000 financed the project.

Manuel Rodriguez Aguilar

Manuel Rodriguez Aguilar, one-time "boy wizard" of the Mexican oil industry whom many credit with originating submarine drilling, died of a brain tumor in Mexico City's British Hospital on July 12. He was 46.

Rodriguez Aguilar, the first petroleum engineer to receive a degree of this kind from Mexico's National University, also held a doctorate in geology from the Colorado School of Mines. He began his career with Royal Dutch Shell in Romania, and later worked for the same company in California, Java, Sumatra and Borneo, where he became general superintendent of operations in the South Pacific islands.

In December, 1939, the Mexican government invited him to join Petroleos Mexicanos.

In 1952, he left Pemex to become petroleum advisor to the Bolivian government and to found a private consulting service utilized by many oil companies throughout the Hemisphere.

Mexican Oil Shows Gains

The situation of the Mexican oil industry is "satisfactory," according to a report by President Adolfo Ruiz Cortines in his annual review of the state of the nation.

Twenty-one new oil and gas fields were discovered in Tamaulipas, Nuevo Leon, Veracruz and Tabasco, according to the report, and exploration is being intensively carried out in Lower California. Reserves are given at 2,886,000,000 barrels, 129,000,000 more than last year. Some 372 wells were drilled in 1956—18 more than in 1954-55. Production was 265,000 barrels a day—15,000 more than in the preceding year.

About 64,200,000 barrels—3,140,000 more than in the past year—were earmarked for domestic consumption, according to the president, and 25,165,000 for exportation—3,130,000 below the former 1955, due to cyclones of September and October 1955. Foreign oil sales amounted to 558,000,000 pesos—5,000,000 less than in 1954-55.

Projects completed included an absorption plant in Reynosa, Tamaulipas, with an output of 8,500,000 cubic meters of gas daily, expansion of the refinery's capacity to 10,000 b/d and installation of a thermic cracking plant of 2,000 b/d; modernization of the Minatitlan, Veracruz refinery, completion of the 20,000 b/d pipe line from Angostura to Veracruz and of the 3,000 b/d propane gas pipe line from Poza Rica to Atzcapotzalco, and the storage plants at Aguascalientes and Guamuchil, Sinaloa. The Tampico-Monterrey pipe line is now under construction.

Capital investments during the 1955-1956 period, including drilling of productive wells, were 959,000,000 pesos ($76.6 million) compared with 780,000,000 in the previous year. Medical and social welfare services and the construction and maintenance of 39 schools cost 61,000,000 pesos.

Projects that the Canal Company had in view at the time of nationalization involved the dredging of 80 million tons of material. The original amount of dredging when the Canal was made was about 100 million tons.

With the U. S., and Europe working in unison, large tankers could load Middle East crude in the Persian Gulf for carriage across to the U. S. The same tankers could then load Venezuelan or American crude for carriage to Europe and then pass round the Cape to Persian Gulf crude again. The total cargo miles would be very little different than compared with the present methods of a cargo voyage one way and a ballast one back.

Papers at Mexican Congress

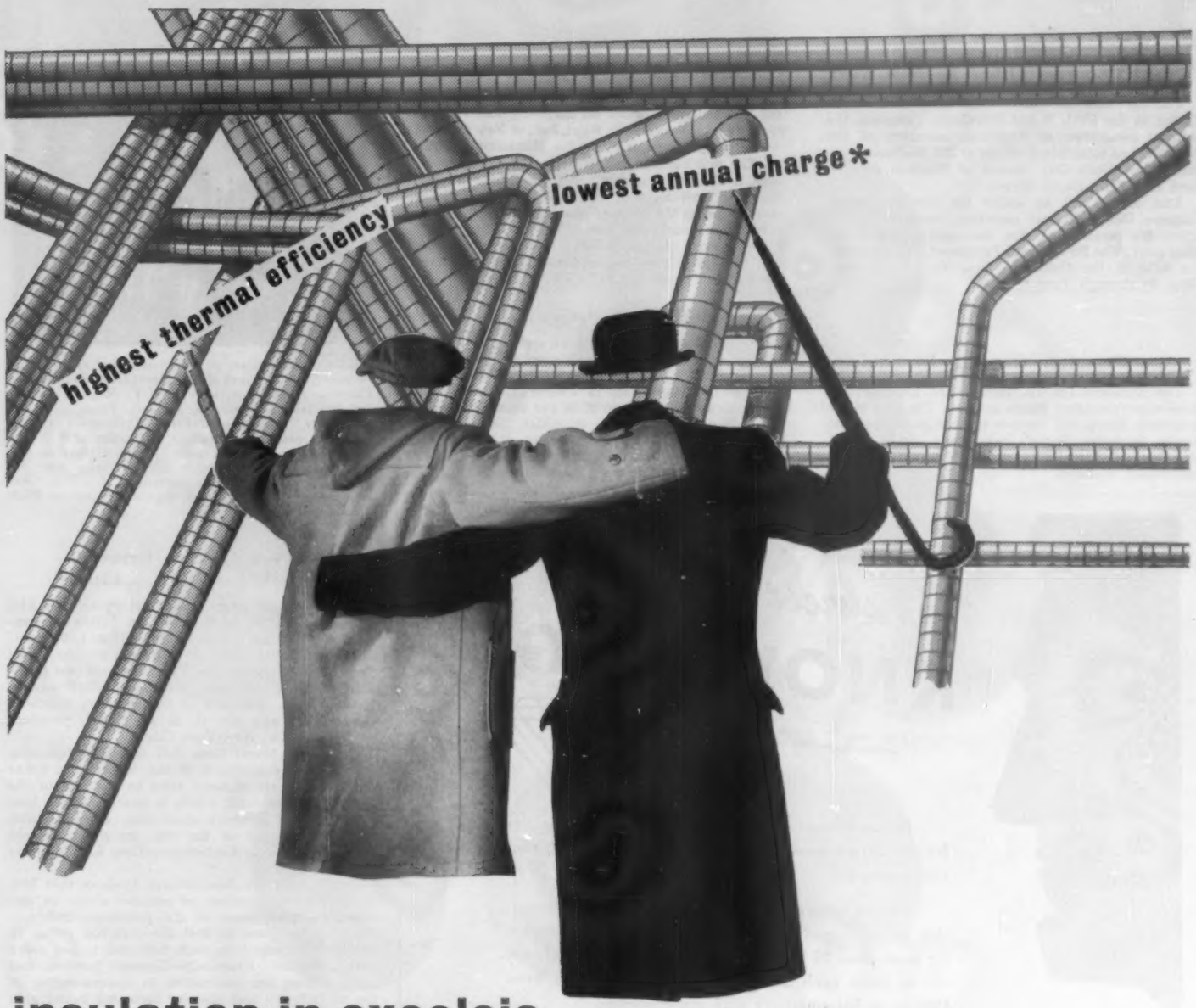
John A. Downing, vice-president of Cree Oil of Canada Ltd. and Link, Downing & Cooke Ltd., presented a paper entitled "Geological Distribution of Oil and Gas in Canada" at the International Geological Congress at Mexico City, Mexico, in September. Mr. Downing was professional delegate for the Alberta Society of Petroleum Geologists at the Congress.

Dr. Theo. A. Link, current president of the American Association of Petroleum Geologists, and president of Cree Oil of Canada Ltd., acted as official professional delegate for the Association at the International Geological Congress in Mexico. Dr. Link presided as chairman for the Oil and Gas Symposium session on September 5th.

New Mexican Storage

Termination of three storage plants by Petroleos Mexicanos on Mexico's west coast will insure an ample supply of fuel to that part of the country, according to a statement by the office of President Cortines. The facilities are located at Tepic, Nayarit, and at Guamuchil and Los Mochis in the State of Sinaloa.

The first has a capacity of 3,000,000 liters (18,868 barrels), the second 2,000,000 liters (12,579 barrels), and the third, 4,600,000 liters (28,931 barrels). With the conclusion of these projects, Pemex increased its storage facilities by some 50%. Similar plans for warehouses at Monterey, Veracruz, Poza Rica and Salina Cruz are expected to lift the nation's stockpiling capacity to 525,000,000 liters (3,301,886 barrels).



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World Congress Office In New York

For the more convenient handling of matters relating to the Fifth World Petroleum Congress, the special committee of American members of the Council has established offices at 527 Madison Avenue, New York City, corner of Madison Avenue and East Fifty-fourth Street.

The offices will be under the direction of C. Eugene Davis, general secretary, recently retired from his position as vice president of Shell Oil Company. The Fifth World Petroleum Congress will be held at the Coliseum, New York City, from May 30 through June 6, 1959.

New Premium Gasoline by Sohio

The Standard Oil Co. (Ohio) has introduced a new super premium Boron gasoline. The new super premium Boron will replace the company's present Boron Supreme. Sohio's new super grade Boron gasoline will be priced at 4c above the price of the company's X-Tane.

Insurance Covers Barge Loss

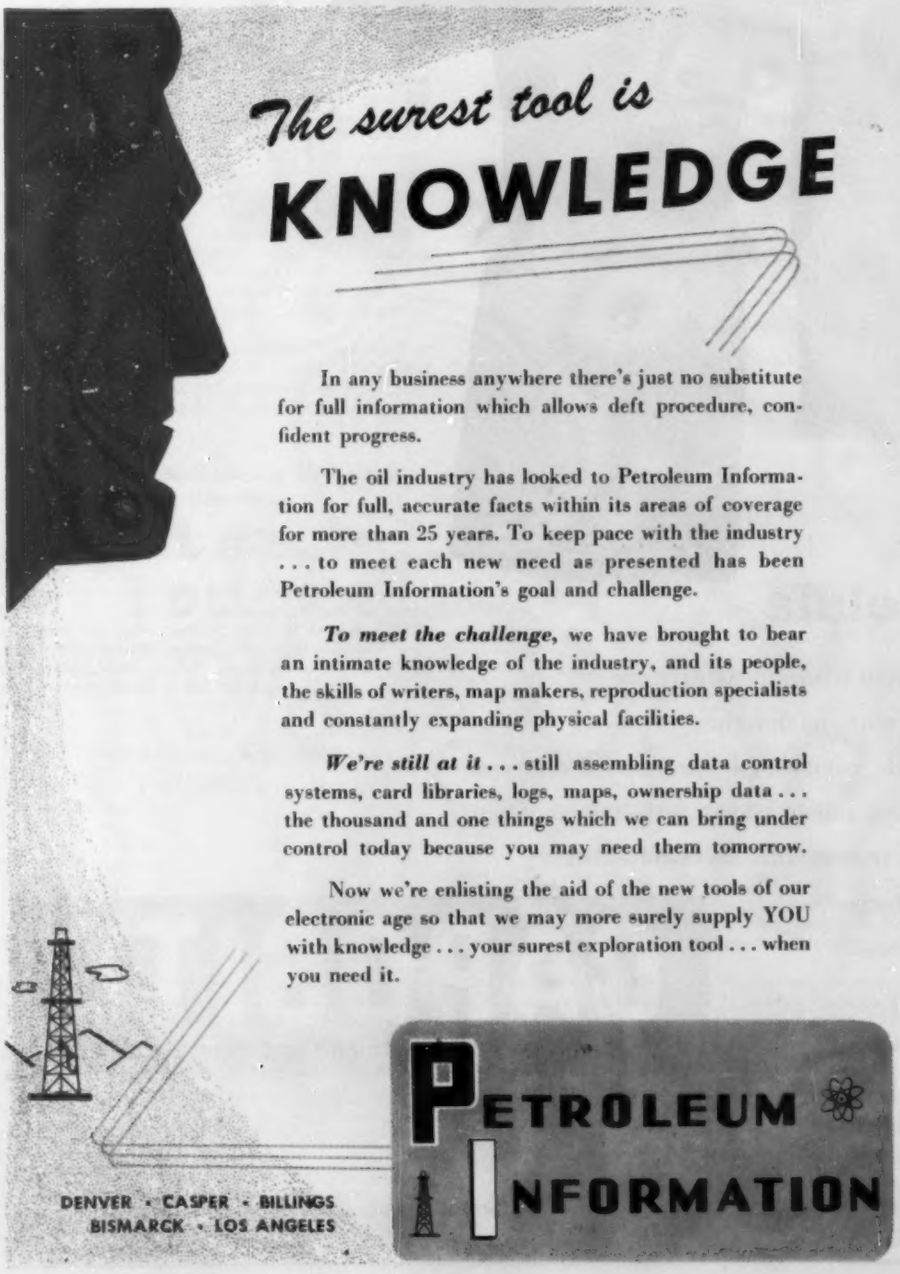
Insurance settlement has been made in full for the $1.3 million offshore oil barge-rig loss suffered recently by the Avondale Ways, Inc., of New Orleans.

The barge-rig capsized in the Mississippi August 10. The drilling unit, a self-contained, diesel-powered S-45 type, was destined to be taken to a 25′ depth or more location in the Gulf of Mexico. Instead of being the conventional type of four-legged derrick, the barge-rig was equipped with a "jack knife" derrick. It was to have been towed into its new position in the Gulf of Mexico two days after the accident occurred.

Gulf Declares 5 Percent Dividend

Gulf Oil Corp. has declared a quarterly cash dividend of 62½c a share and a 5% stock dividend both payable Dec. 6, 1956, to shareholders of record at the close of business Oct. 15. This brings Gulf's cash dividends for the year to $2.50 per share. It marks the fifth consecutive year in which the company has supplemented its cash dividends with a stock dividend. In 1955, the company paid cash dividends of $2.25 per share and a 4% stock dividend.

Newly elected officers of the Association of Desk and Derrick Clubs of North America are: (left to right) Miss Florynne T. Brandon, with Cecil V. Hagen (geologist and independent operator), Houston, Texas, treasurer; Miss Betty Todd, from Brinkerhoff Drilling Co., Denver, Colorado, second vice-president; Miss Maxine R. Hacke, from Warren Petroleum Corp., Tulsa, Oklahoma, first vice-president; Miss Lavada Clayton, from Gulf Oil Corp., Wichita Falls, Texas, secretary; Miss Irma Cline of Nelson, Montgomery, Robertson and Sellers in Wichita Falls, Texas, president.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New Orleans Greets Desk and Derrick Club

The Desk and Derrick Association held its fifth annual convention at New Orleans during September 7 and 8, at the Roosevelt Hotel. Over 1,200 members attended to listen to addresses by Mrs. Sybil Sureck of Oklahoma City, the immediate past president of the Association. Mr. Bruce K. Brown of New Orleans, president of the Pan-Am Southern Corporation, and Mr. H. S. M. Burns, president of Shell Oil Co., New York City.

A colorful Mardi Gras Ball was held following discussions by members of the Association. Other features include planned trips to the site of the world's deepest well, which is nearby, and a boat ride to watch offshore operations, among others. There were tours of the city, including the old French Quarter, and other attractions for the members as well.

It is part of the Association's by-laws that 80% of all regular meetings of member clubs be devoted to some phase of the petroleum industry. From its inception in 1949 the club has grown to nearly 10,000 members, each dedicated to her club's motto, Greater Knowledge-Greater Service, and gaining from her association in understanding of the oil industry and thereby becoming better able to play her part therein. All those attending at New Orleans came away with cherished memories of a beautiful city and the Mardi Gras ball, but they received a better understanding of their part in the petroleum industry as well, which will enable them to do a better job in the future and to appreciate their part in the oil industry.

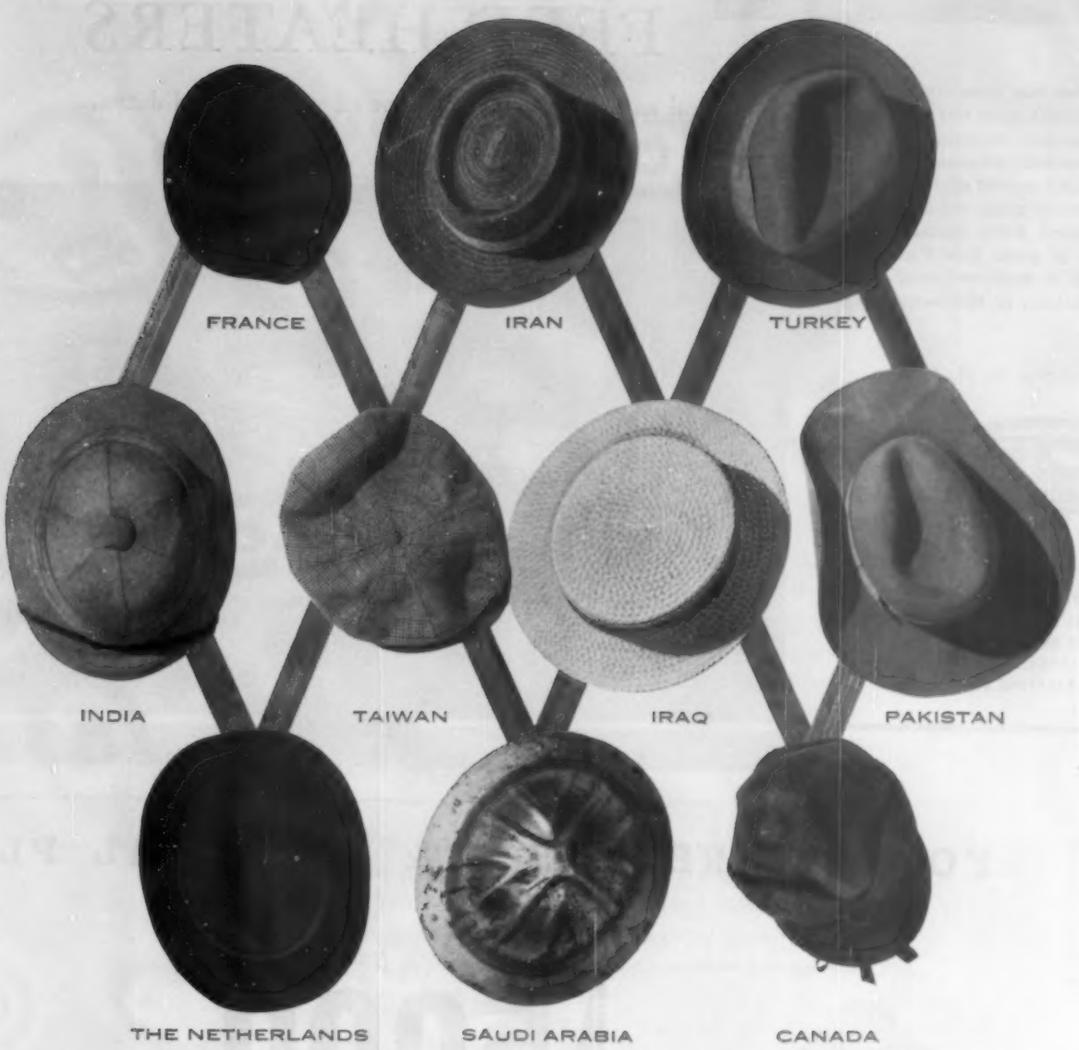
Southern Geophysical Appointment

Frank Steen has been appointed assistant to the president in charge of public relations of Southern Geophysical Co.

863,800 Employed in U. S. Oil

Total employment in all segments of the oil and natural gas industries in the United States, excluding retail outlets and retail services, was estimated to be 863,800 persons as of July 1, 1955, according to a report adopted by the National Petroleum Council. It was further indicated that 7 out of every 100 total employees in the oil and gas industries are scientists or engineers.

Where applicable, employment data is broken down by P.A.D. districts. The report shows that 313,500 persons (36.3%) were employed in petroleum and natural gas exploration and production. In petroleum and products refining, it is estimated that 209,400 persons (24.2%) were employed. A total of 113,000 employees (13.1%) were engaged in the transportation division, including 33,000 employed in the transmission of natural gas (up to the "city-gate"). 227,900 persons (26.4%) were employed in the distribution division.



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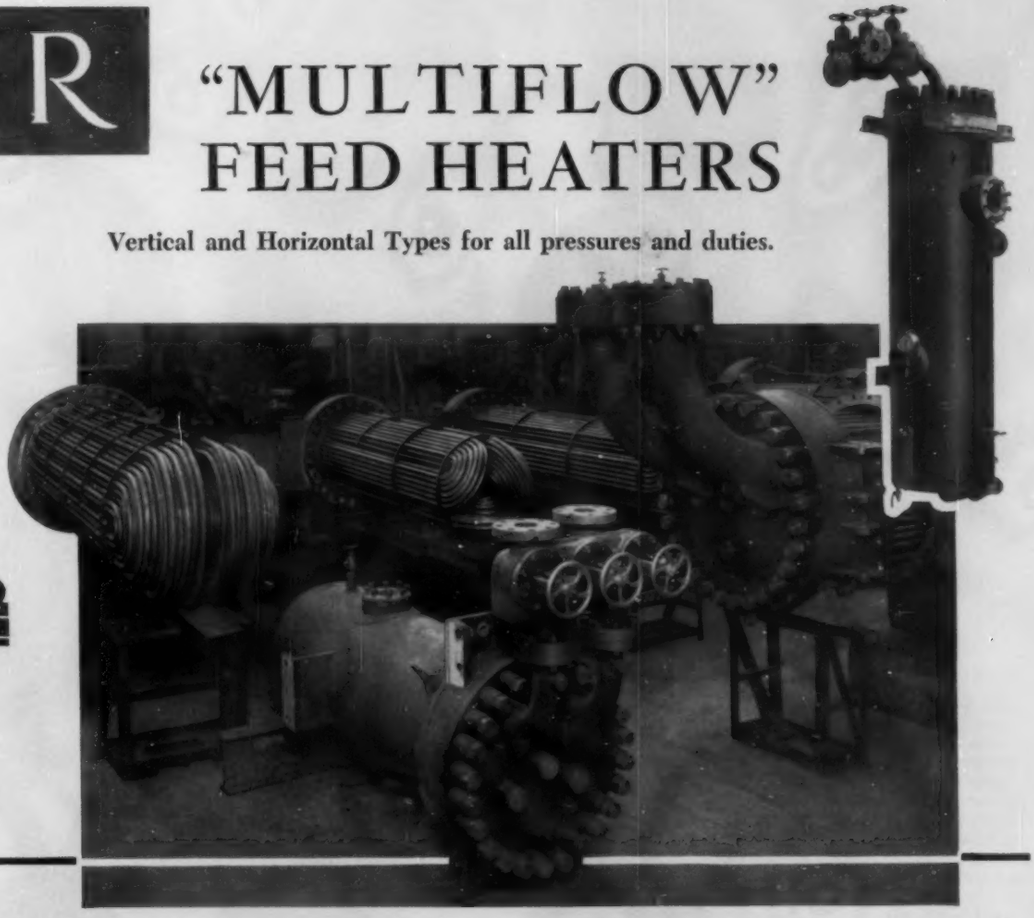

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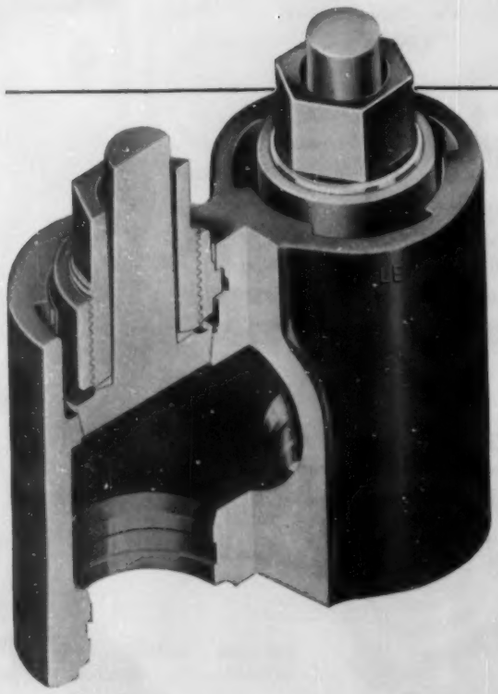

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You are invited to see the GSI data processing concept illustrated in our displays of record sections at the annual SEG meeting in New Orleans, October 29-November 1, and at the Pacific Section, AAPG, in Los Angeles, November 8 and 9.

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New Pipe Mill for Louisiana

Cal-Metal Pipe Corp. of Louisiana is installing an electric resistance weld continuous mill to produce A.P.I., A.S.T.M. and A.W.W.A. specification line pipe for the gas, oil, water and construction industries at its Baton Rouge, Louisiana plant.

The new mill will have a rated monthly capacity of 5,000 to 7,000 tons of standard and light weight pipe in sizes ranging from 6 inches through sixteen inches diameter. This new facility will more than double Cal-Metal's present pipe manufacturing capacity, making it one of the largest independent steel line pipe manufacturers in the United States.

The new mill was designed and is being constructed at the present time by Cal-Metal Corp. and Torrance Specialty Fixtures, Inc. of Torrance, California, manufacturers of heavy mill equipment. The mill is scheduled for its initial production run in early 1957.

Hydroformer on Stream at Fawley

Esso Petroleum Co. Ltd. has completed its new £4 million Hydroformer at Fawley, the first to be built in a British Refinery. Construction was begun in March 1955 and completed in March of this year.

Gas Turbines

A large number of representatives of the technical press were present at the Lincoln Works of Ruston & Hornsby, Ltd., recently when six gas turbines running on various fuels and under different operating conditions were on view.

An agreement has been entered into between Ruston & Harnsby, Ltd. and Dresser Industries, Inc., under which Clark Bros. of Olean, New York has sole rights to manufacture the Ruston Gas Turbine in the United States. A turbine which will burn either gas or gas oil will be sent to the U. S. shortly for demonstration and sale.

John W. Mecom

Mecom Elected Director

John W. Mecom has been elected a director of the Reed Roller Bit Co., succeeding James Anderson, who died July 29. Mr. Mecom owns interests in extensive oil producing properties in Texas and south Louisiana, and also operates in Colombia, Honduras, and Haiti. He owns Cron and Gracey, a drilling contracting firm, and three manufacturing companies: Cardwell Manufacturing Co., Boonton Molding Works, and Polymer Engineering Corp. In 1955, he formed a partnership with San Jacinto Petroleum Corp., known as Mecom Petroleums, which operates both on and offshore in Louisiana.

U. S. Oil Plant Expansion Up 19%

The American petroleum industry expects to spend about $3,341 million for plant expansion during 1956, according to a compilation of company plans reported to the Securities and Exchange Commission.

The year's total was reported when fourth quarter plans for capital expansion were reported to SEC at $979 million. During 1955, the industry spent $2,798 million, and in 1954 $2,684 million. The figures are for petroleum and coal, plant and equipment expenditures. By quarters of this year, the petroleum and coal spending is estimated as follows: 1st, $627 million; 2nd, $803 million; 3rd, $932 million; 4th, $979 million.

$3.5 Billion in Plane Orders

International and domestic airlines are progressing rapidly with plans to add new equipment to their fleets for what is predicted to be a three and a half billion dollar investment in the future by dozens of airlines, according to ESSO AIR WORLD, aviation house publication of the Esso international aviation petroleum service organization. The grand total of all makes and models ordered by airlines as of August 8 for delivery through 1960 is 1,485 transport aircraft. Of these 64% or 948 aircraft are U.S.-built transports; 484 (primarily Viscounts, Britannias and Comets) are British, with French and Dutch types accounting for 22 and 31 planes, respectively.

The monetary value of all turbine powered (pure jet and prop jet) aircraft ordered for delivery by commercial airlines through 1960 is estimated at approximately $2.4 billion; the value of piston powered planes scheduled for delivery through 1958 is about $1.1 billion.

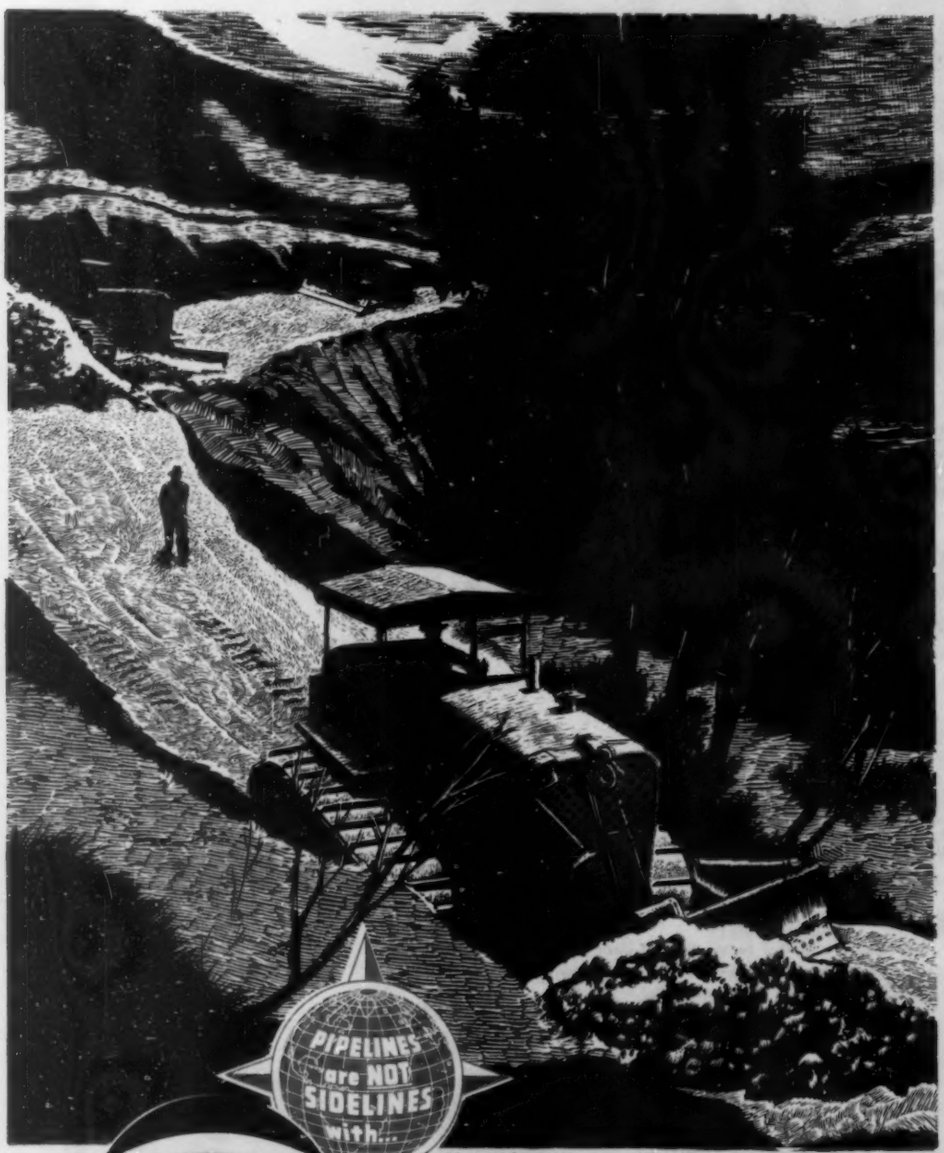
Following are the total of confirmed airline orders by category and by numbers of transport aircraft to be delivered during the years listed:

Long Range Piston Powered: 454 total—142 being delivered this year, 257 will be delivered in 1957, and 55 in 1958.

Medium Range Piston Powered: 157 total—55 being delivered this year, 84 will be delivered during 1957, and 18 to be delivered in 1958.

Medium Range Turboprops: 401 total—of which 166 either are in service or will be delivered by the end of 1956, 120 to be delivered in 1957, 96 in 1958 and 19 in 1959.

Long Range Pure Jets: 284 total—16 to be delivered in 1958, 102 in 1959 and 166 in 1960.



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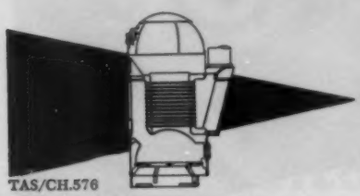
The tube-plates are hot-pressed in a single operation; the flue-pipe hole in the back tube-plate (see illustration)—is burnt out and flanged in a separate operation. The plates are annealed before the tube-holes are drilled. The edges of the tube-plates are saw-trimmed at a later stage, after the boilershell has been drilled for riveting.

The marking off and drilling operations require the greatest care to make certain that subsequent fitting of the tubes into the boiler is satisfactory: this is just one operation of the many subjected to the strictest supervision throughout the construction of each boiler, thus ensuring a first class product on completion.



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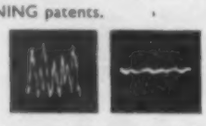

Oscilloscope recording shows pulsation (left) and smooth flow attained after fitting BURGESS Snubber (right).

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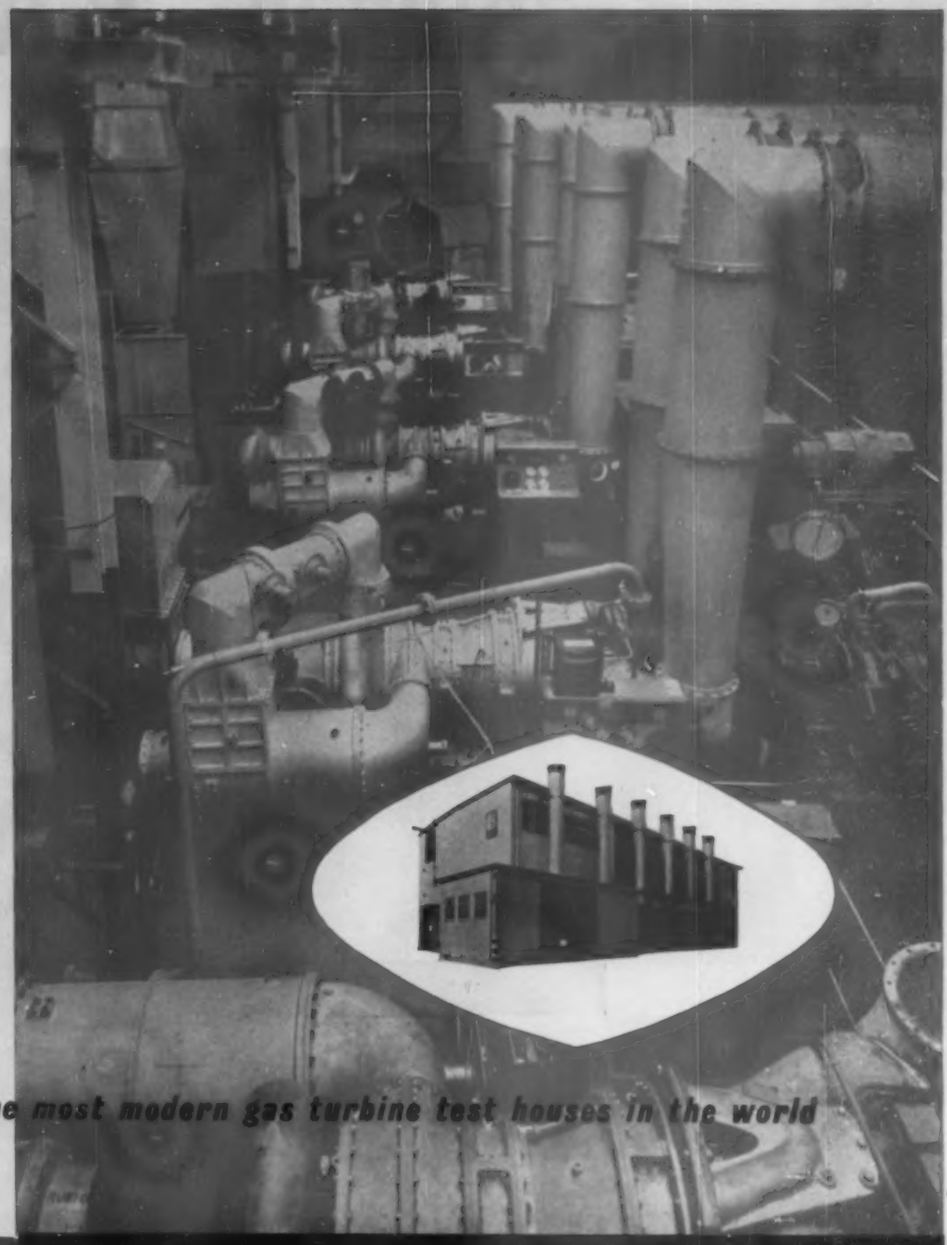

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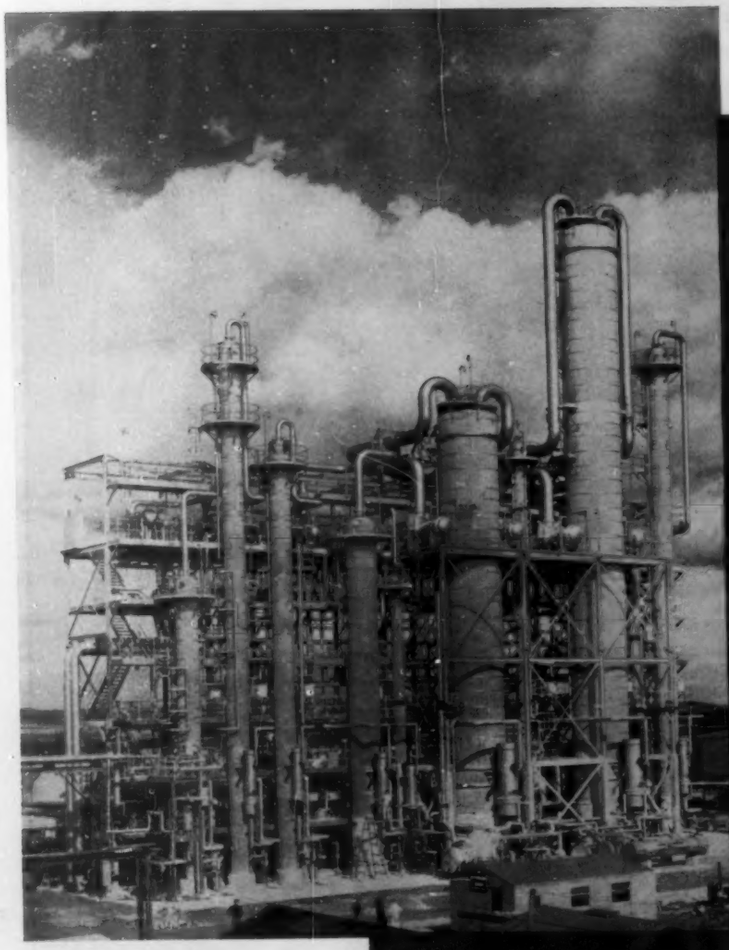

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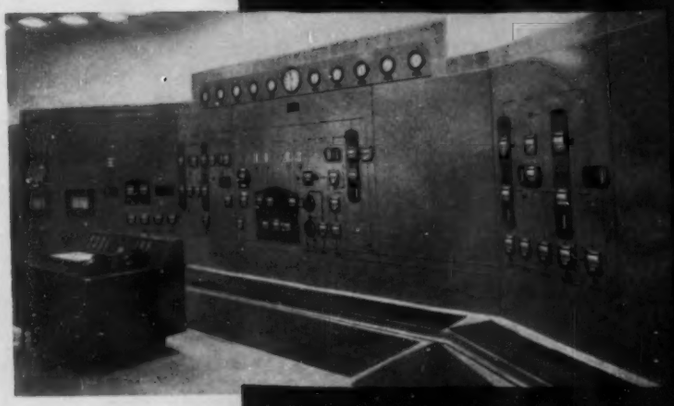

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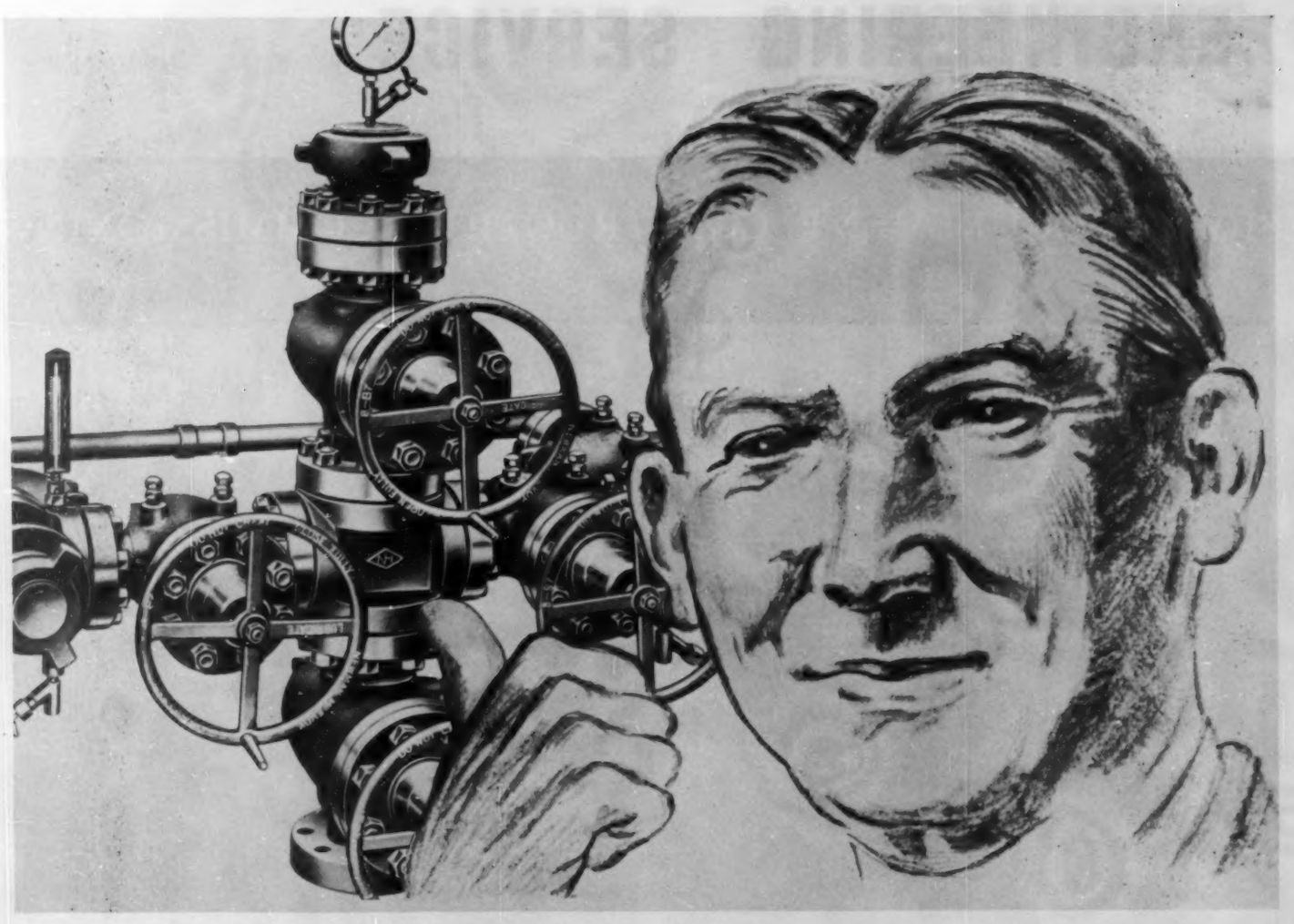

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Hunting Enters United States

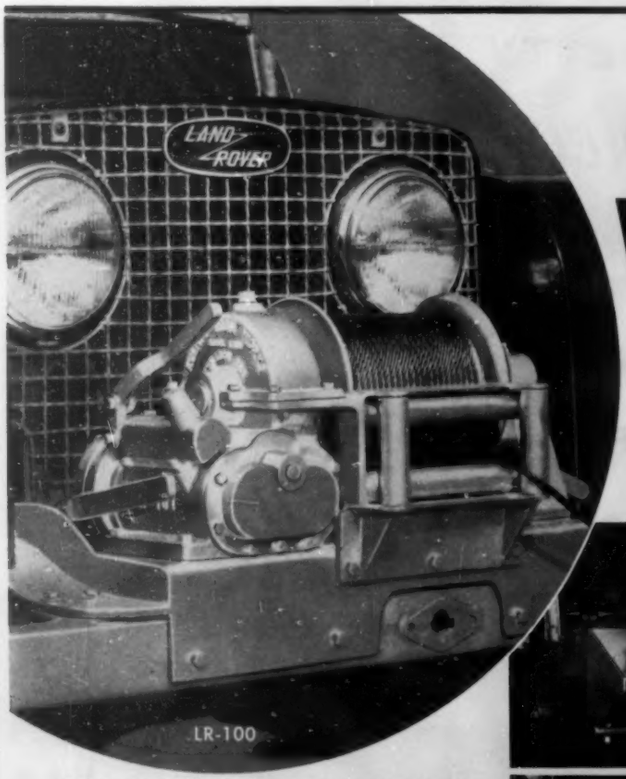
Hunting Technical Services Inc. has been organized to represent Hunting Aerosurveys Ltd., Hunting Geophysics Ltd., The Photographic Survey Corp., Ltd., and Aeromagnetic Surveys Ltd., in the United States. Offices were opened on Oct. 1 at 57 Park Ave., New York 16, under the management of Lord Pentland who has been elected executive vice president of the new company.

A brochure has been prepared to describe the aerial and ground survey work done by the companies for oil, mining and other companies. The brochure is illustrated with aerial photographs and plastic overlays to show a combination of photo interpretation and ground examination data. The brochure bears the title: "Ninety-two Million More Mouths to Feed."

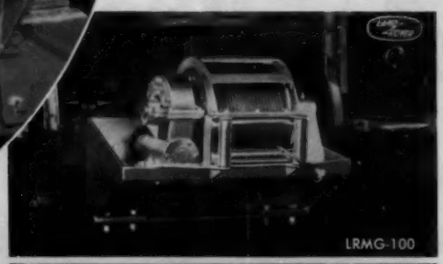
25,000 B/D Asphalt Plant at Yorktown

The American Oil Co. will add a 25,000 b/d asphalt plant at its Yorktown, Va., refinery now nearing completion. The company's decision to add the asphalt capacity is part of a long range program to expand facilities to meet the needs for road building materials created by the 13-year Federal highway building program.

The company, one of the largest marketers of asphalt, has started engineering and design work for the construction of this new asphalt processing unit. Recently the company announced the first gasoline ever produced in Virginia would be manufactured in early November at the originally announced 35,000 b/d refinery at Yorktown. Full operation of the gasoline refinery is scheduled for early 1957.



The KING WINCH for LAND ROVER



THE REVERSIBLE KING WINCH WITH PROVEN DEPENDABILITY

Custom-made for the Land Rover, this reversible front-mount King Winch has been service-proven in the field. Even in the most rugged terrain, this combination of the King R-100 and the Model 30 drive assembly assures long, dependable, trouble-free operation. Other important features of the LR-100 include:

- ★ easily installed in 2 hours . . . no cutting or bending necessary
- ★ bronze-bushed 4-way cable guide
- ★ free-spooling winch drum with drag brake
- ★ forward, neutral and reverse operating lever conveniently mounted on winch
- ★ crank-shaft drive with double-friction clutch in oil bath
- ★ pulling capacity . . . 8000 lbs.
- ★ hoisting capacity . . . 1500 lbs. on single line, 3000 lbs. with double line and sheave block

REAR-MOUNT KING WINCH FOR LAND ROVER

The rear-mount King Winch drives from the center power take-off and has the following features:

- ★ attachment to Land Rover drawbar
- ★ all-steel welded platform
- ★ cable drum guard protection (Model LRMG-100)
- ★ 4 speeds forward, one speed reverse . . . operator in driver's seat

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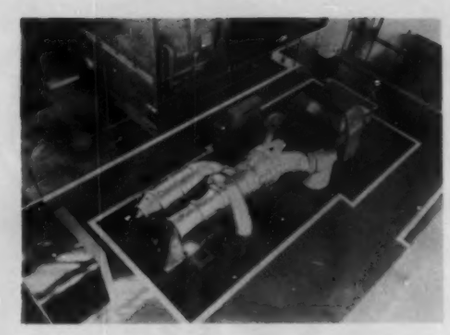

Clark Bros. Presents New Turbine

A versatile gas turbine of 1,130 bhp has been recently presented by Clark Bros. of Olean, New York, one of the Dresser Industries. Developed in England by Ruston-Hornsby, Ltd., it has proved its versatility and reliability in many parts of the world, including 3,000 hours of trouble-free operation at the end of 1955 in the Cortemaggiore gasoline plant of Azienda General Italiana Petroli (AGIP). Details of the design have been covered in a previous article (World Petroleum, April, 1956, page 58). The turbine will answer a need for a prime mover of this size in the U. S., where it has not previously been available.

Sun Pioneers Bunker "C" Use in Tankers

Sun Oil Co. is the original pioneer in the field of bunker "C" use for tanker propulsion, according to Charles L. Boyle, marine-department manager, who states Sun has been using bunker "C" fuel oil in its diesel-engine tankers since 1932 and is still using it in five of its large tankers operating on ocean routes.

The Sun Shipbuilding & Dry Dock Co. has had a patent license from William Doxford & Sons for the manufacture of Doxford diesel engines since about 1922. The second Doxford engine constructed by Sun Ship was installed on the MS "Bidwell" in 1923 and this vessel is still operating with the original engine on bunker "C." Sun Oil Co. undertook the study of converting the Doxford engine to the use of bunker "C" fuel, and in 1932-1933 all Sun motor vessels were converted to bunker "C" from straight diesel fuel.

Sun Oil Co.'s experience with the Doxford engine was applied to the smaller and high-speed diesels for auxiliaries which are used for driving the generator engines on Sun tankers. This in turn led the manufacturer of these auxiliary diesel engines to consult with and adopt Sun practices, techniques and applications to land installations, a power plant in Nantucket, Rhode Island, being about the first to convert from diesel to residual fuel (bunker "C").

With the advent of catalytic cracking in the refining process, the viscosity of the bunker "C" fuels rose considerably, but the Sun Oil Co. made changes in its original design to keep pace with this increase in viscosity and has bunkered its motorships with bunker "C" fuel in all parts of the world.

Carra L. Lane

Ott Hammer

Lane Appointed President

Carra L. Lane has been appointed president of Security Engineering Division, one of the Dresser Industries, with headquarters in Dallas, Texas. Mr. Lane's appointment follows the promotion of Ott Hammer to a vice presidency of Dresser Industries, Inc. Mr. Hammer has been associated with Security since May, 1947.

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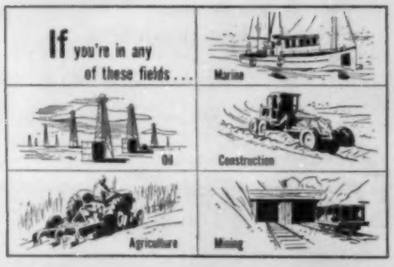

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AW(50) gives maximum metal deactivating efficiency and economy. Improved color, too, and because of its better solubility and pumping properties, it can be injected directly into gasoline or other refinery streams without the customary dilution with aromatic spirits.

AW(50) is supplied in handy five-gallon containers for manual addition or blending with other additives and in 55-gallon drums for automatic injection systems.

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Pronounced "Inner Clad"

Reed's advanced hard metal application for Tool Joints...

Inarclad utilizes Reedite hard metal to protect tool joints as do Reed's two other methods (Surface Concentration and Deep Penetration) . . . but . . . Inarclad differs in the process used in that Inarclad welds the hard metal into the tool joint steel rather than binding the hard metal onto the surface of the tool joint.

The application of the hard metal with the new method is done by an automatic electric welding machine utilizing an inert arc process. Using a non-consumable electrode, an electric arc melts the tool joint steel into a puddle at the proper spot. Hard metal grains are fed into the puddle automatically. The arc is shielded by a continuous flow of inert gas to prevent contamination or oxidation of the steel during the melting process.

ADVANTAGES

1. Inarclad uses the high alloy steel of the tool joint itself as the binder for the hard metal. Reduces chances of spalling or flaking!
2. The steel of the tool joint will not become oxidized by the heat of the weld because the arc is operating in an inert atmosphere.
3. The weld is made by an automatic machine which eliminates human errors. Superior weld quality!
4. Reedite is fed into the weld by machine, thus giving a better distribution of hard metal throughout the band. Uniform, measured amount of hard metal is put into each band!
5. The hard metal is distributed uniformly in depth through the band. This assures that a uniform number of hard metal grains are always resisting abrasive wear until the hard metal is worn completely away. Uniform wear rates!
6. The hard metal bands have a concentration of hard metal approaching that of Surface Concentration method and equal the depth of Deep Penetration method. More hard metal!
7. The hard metal is applied to the tool joint without recessing and results in a slight surface build up. This build up equals approximately 1/32 in., which increases the tool joint O.D. about 1/16 in. The O.D. of the tool joint remaining after all the hard metal has worn away is 1/16 in. larger than it would be if the same bands had been laid in recesses.

Unretouched photo of Inarclad cross section sample.

REED **leadership in tool joint design.**

THE MARK OF QUALITY

REED ROLLER BIT COMPANY, HOUSTON 1, TEXAS NEW YORK LONDON BUENOS AIRES

Sinclair Debenture Issue

Sinclair Oil Corp. is planning to issue about $165 million of convertible subordinated debentures. It plans to offer its stockholders rights to subscribe on the basis of $100 in debentures for each nine shares of common stock. The offering will be underwritten by nationwide investment banking houses managed jointly by Smith, Barney & Co., and Merrill Lynch.

The company will have invested more than $570 million in property additions, not including an outlay of $114 million made or expected to be made on important acquisitions to supplement the company's day-to-day search for crude oil. Last year's acquisition of properties formerly owned by American Republics required a cash outlay of $24 million. The anticipated purchase of properties from Southern Production Co. will call for an expenditure of $43 million. An approximate 30% interest in Texas Pacific Coal and Oil Co. was acquired for $47 million.

Shell Chemical Co., Egham Laboratories

The Egham Technical Service Laboratories of the Shell Chemical Co. were officially opened May 3 by Sir Lionel Heald. These laboratories which occupy a floor space of 23,000 sq. ft. have been completely built and equipped and provided with ancillary services at a cost of £300,000.

The various sections of the laboratories cover surface coatings, paint making, resins, detergents, general chemicals, and market developments.

Agricultural Research Center

The new £150,000 extensions to the Shell Woodstock Agricultural Research Center, Sittingbourne, Kent were formally opened on May 15 by Sir William Slater, executive secretary of the Agricultural Research Council.

Duane O. Wood

Elected to Hycon Board

Duane O. Wood, has been elected to the board of Hycon Aerial Surveys, Inc., Pasadena, California. He will continue as executive vice president and general manager. A subsidiary of Hycon Manufacturing Co., Hycon Aerial Surveys performs worldwide aerial mapping and geophysical surveys.

O'Connor Inspects Romanian Oil Equipment

J. B. O'Connor, executive vice president of Dresser Industries, Inc., recently returned from Romania where he was invited by the Foreign Trade Ministry. Leaving Romania with a strong impression of the development of its oil-field equipment industry, he considered Romanian oil-field equipment among the best in Europe. He said Dresser had in the past close commercial relations with Romania and that he hoped these connections would be resumed and extended.

New Refinery Posts at Tidewater

The appointment of eight men to supervisory posts at Tidewater Oil Co.'s new 130,000 b/d Delaware Flying A Refinery, has been announced. They are: Elwood C. Bailey, supervisor of the crude area; Robert C. Carter, supervisor of the cracking area; Roger W. Edwards, supervisor of the alkylation and polymerization area; Gordon G. Gaddin, supervisor of the reforming area; Paul W. Jepsen, supervisor of oil dispatching; John J. Mack, chief engineer; John Searl, supervisor of the utilities and sulfur recovery area, and Clarence E. Slater, supervisor of the coking area.

H. W. Arduser

M. L. Walraven

Win-Well Sales Appointments

Arduser & Co., Tulsa, and Specialty Sales and Service, Inc., Odessa, have been appointed sales representatives for Win-Well Manufacturing Co. of Los Angeles which recently introduced the Win-Well 7-way multiport selector valve, designed for the control of bulk liquid flow, which enables oil producers to make radical changes in testing, metering and sampling.

Arduser & Co., headed by H. W. Arduser, will handle sales in the Oklahoma territory. Specialty Sales and Service will handle the Dallas-Ft. Worth and West Texas sales area with headquarters in its Odessa branch, managed by H. W. Wood. SS&S president is M. L. Walraven, Tulsa.

Murray & Tregurtha

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solve **tough marine power and steering problems!**

Models from 40 to 400 h.p. (Series O-4 illustrated; 40 - 50 h.p., Gas or Diesel).

Steer in any direction with full power

Easy service and low operating costs

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Rugged, trouble-free performance

You can solve your tough power and steering problems with Harbormaster Outboard Propulsion and Steering Units . . . the complete heavy duty marine power packages. They are quickly and easily installed for immediate use. They are efficient, economical to operate and maintain . . . and they have many special features not found with ordinary marine power, so they are the answer to many tough marine problems.

If you need easily installed power, better steering control, safety in shallow water, easier maintenance, more efficient performance, simpler hull design, more cargo space, bigger payloads, or simplified crew operation . . . you should investigate the benefits of Harbormaster Outboard Propulsion and Steering.

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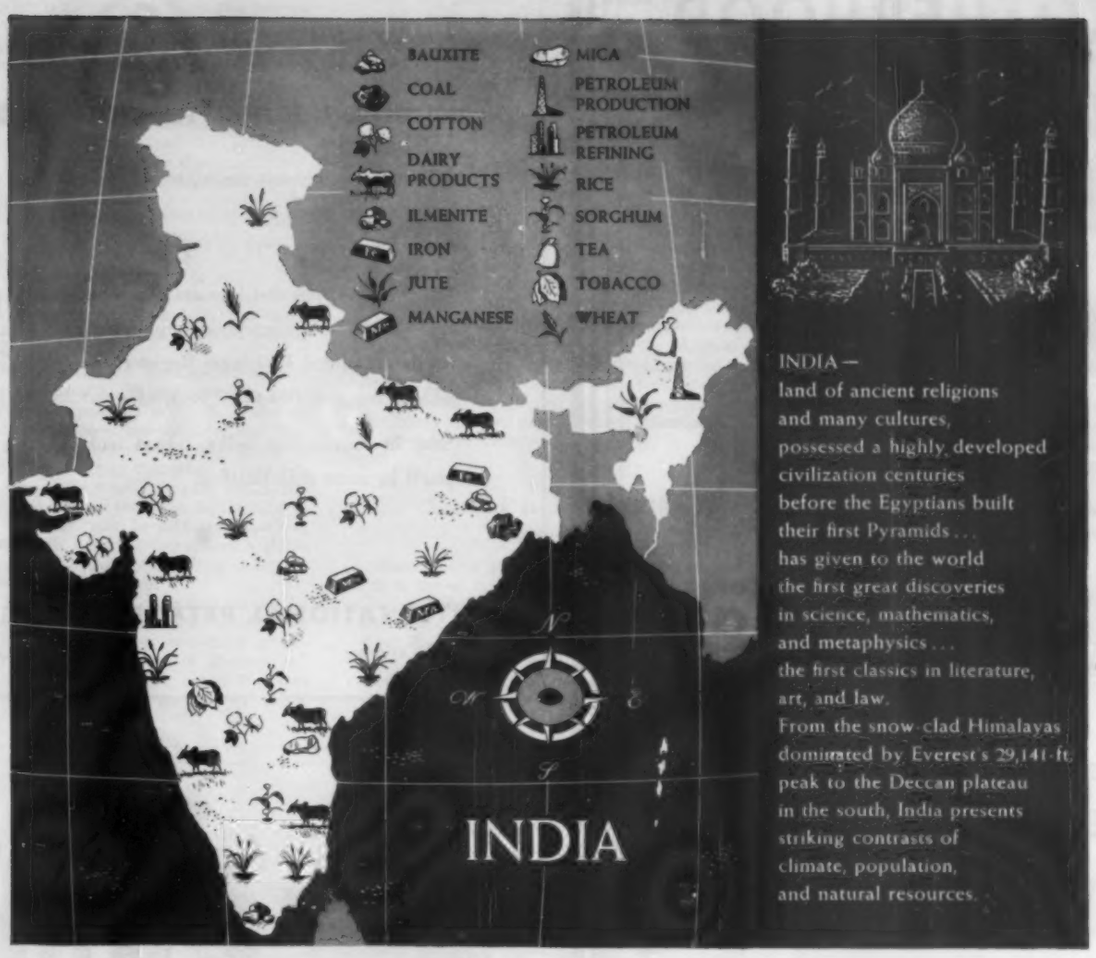

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peak to the Deccan plateau
in the south, India presents
striking contrasts of
climate, population,
and natural resources.

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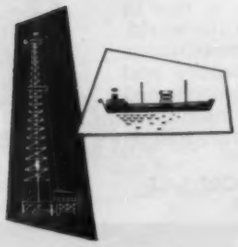
With area of 1,269,640 square miles and a population of 377,000,000, India is the second most populous nation in the world, and the world's largest democracy. India achieved her independence on August 15, 1947.

In 1951 India put into effect her first Five Year Plan of economic development, raising national income by about 11 per cent, and achieving self-sufficiency in food production. Today a second and more ambitious plan is already under way. The Stanvac refinery at Bombay, which went on stream in 1954, is currently producing over 300 million gallons of petroleum products annually... products that help turn the wheels of India's industry, transport, and farm machinery.



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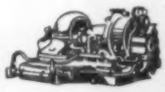

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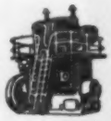

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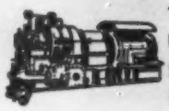

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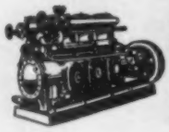

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World Crude Oil

(*Continued from page 87*)

crudes into the Eastern Hemisphere, particularly Europe which is threatened with loss of its major source of supply by both the Suez crisis and unrest in the pipe line transit countries of the Middle East. The same prospects for increased production apply to Canada, which has begun shipments of crude to California and looks confidently to that market for greatly increased future sales. Canadian exports to the United States would grow even more in the event of a closure of the Suez Canal.

Despite these good prospects, the Western Hemisphere has continued to lose ground in its relative world-wide importance as a crude supplier. In 1953 about 68.6% of world crude supplies came from the Western Hemisphere. In 1954 this dropped to 66.3%; in 1955 the figure fell to 64.5%, and in the third quarter of this year it slipped to 63.2%. The Eastern Hemisphere has continued to grow, from 31.4% to 33.7%, then to 35.5% and in the third quarter of this year supplied 36.8% of the world crude production.

The decline of the Western Hemisphere is due primarily to the failure of U. S. production to keep pace with world expansion. The U. S. share of world production dropped below half for the first time in 1953, and has declined steadily since to 42.6% in the third quarter of this year. It has reduced North America's share, despite small increases in Mexico and large increases in Canada, to below half for the first time in 1954 and down to 46.3% this year. South America has shown a slight increase this year, but not sufficient to maintain the Western Hemisphere's share.

The Eastern Hemisphere has absorbed all of the increase and at the end of the third quarter this year was supplying slightly over one-third of the world crude production. The area of greatest increase was the Soviet Union, which raised its share of world production from 8.6% in 1955 to 10.9% this year, an increase of 2.1%. The Middle East showed the next largest increase, greater in absolute amount than the Soviet Union's, rising from 21.3% in 1955 to 22.2% in the third quarter of this year. The Suez crisis has not affected Middle Eastern production as yet, but if the canal were closed the amount shipped would drop by about 800,000 b/d, this latter amount representing the quantity which would have to be supplied to Europe from the Western Hemisphere, replacing imports from the Middle East.

Europe and Africa have increased their production recently but their heightened production rates have only slightly exceeded the world rate of increase and the area's share has risen less than one-half of one percent, to 12.1% in the third quarter of this year. Recent discoveries in Algeria and other parts of Africa, combined with intense exploratory activity in Europe, may raise this area's share in the future. Any substantial production developed in, for example, Algeria would have a considerable impact, due to its proximity to markets if the initial transportation difficulties can be overcome to place the oil at tidewater. Recent discoveries at three locations in Algeria have aroused the French government's hopes for a major strike. The difficulties of transportation, even if major fields are found, are tremendous, however. The same applies to the recent discovery in Iran, as covered elsewhere in this issue. END

Visit of Kuwait Sheikhs to Aden Refinery

Sheikh Jabir al-Ahmad, who is in charge of security in the oil installations in Kuwait and his brother Sheikh Sabah al-Ahmad, who have recently been in London for a 10 day visit, paid a visit to the Kent Refinery of the British Petroleum Co. Ltd., on August 3rd. They inspected fire fighting arrangements, and security services as well as the general plant.

Eloise (Mike) Michel

Michel Joins World Petroleum

Eloise (Mike) Michel has joined Palmer Publications as an associate editor, following her retirement from the American Petroleum Institute this year. Before her retirement, Mike Michel spent more than 30 years with the API, in her last capacity as editor of technical publications and of the API QUARTERLY. She has made many friends, both in the Institute and throughout the country, who will welcome her return to the industry and wish her well. Miss Michel's new duties as an associate editor will comprise supervision and general editorial work in the New York offices of WORLD PETROLEUM.

Geelong Refinery Harbor Deepened

A dredging program has just been started in Corio Bay, Victoria by the Geelong Harbor Trust, which will enable super tankers up to 32,000 to discharge into Shell's Geelong refinery tanks. Cost will be about £1,400,000 ($39 million) and the project is scheduled for completion in 1958.

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Russian Oil Equipment

(*Continued from page 75*)

tures drilling tools, a great variety of extraction and processing installations, pumps, compressors, etc. At present, Romania is the Soviet Orbit's biggest exporter of oil equipment. To China alone, Romania supplied 22 drilling rigs.

Czechoslovakia specializes in processing installations—from primary distillation to catalytic cracking aggregates—and in tubing goods of all dimensions. Eastern Germany produces refining vessels but concentrates mainly on pumps, compressors and turbines. Hungary also has started to build oil installations for its own needs, and components for a thermal cracking plant to process the very heavy and sulfurous Nagylengyel crude. Poland is slated to become Eastern Europe's biggest producer of tubular goods.

A great deal of the oil equipment manufactured by the occupied countries is sent to Russia which, in addition, directs their export within as well as outside the Soviet Orbit.

After the wide publicity given Russian turbodrills, Russian and Romanian foreign trade magazines distributed in the West have started to list virtually every general type of oil equipment for export in unlimited quantities. At recent trade fairs and industrial exhibitions in Western Europe, oil equipment from Eastern Europe was also exhibited. But no serious attempt has been made to find outlets in the West for Soviet-made equipment. Russia at present directs her exports of oil equipment to the under-developed countries of Asia and the Middle East, with a political strategy in mind.

Of late, the Soviets are offering those countries package deals for developing their mineral and power resources, in which oil equipment is but one ingredient. The deals are being offered together with the Soviet recipe for "how to do it alone" and, thereby, avoid dependence upon Western aid and trade. The Soviet formula for economic expansion is sold as a means of avoiding Western "colonialism." The Soviet alternative tends to stir up crises such as Suez and encourages heavier taxation and higher royalties. Russia's inducements are aiming, in the first place, at building in this area potential economic enemies to the West, and at closing the gates to Western venture capital.

The emerging Soviet technical capacity, and the ensuing sales strategy may prove to be a far greater political threat, and infinitely more difficult to deal with, than Russia's military potential. Economic nationalism of the Asian countries would be a far lesser challenge were it not backed up by Soviet promises of technical help, and by Russia's symbolic gesture as "the mighty friend of the weak against the strong." END

Soviets to Build Atom-Powered Oil Tanker

Atomic power plants for oil tankers of over 20,000 dwt are to be built in Russia, according to Khachaturov, Director of the Institute of Complex Transport Problems. Calculations have shown, Khachaturov said, that, with no rise in cost, the speed of the delivery of cargo in ships with atomic power engines can be increased by 40 to 50%.

The Soviet Union recently laid a keel for an atom-powered icebreaker.

Butane Conversion by Atomic Energy

The Atlantic Refining Co. has announced discovery of a new method for synthesizing gasoline by the use of atomic energy. In a paper presented before the American Chemical Society at its 130th national meeting at Atlantic City, Dr. F. J. Keenan and his colleagues from Atlantic's Philadelphia research laboratories described the bombardment of butane hydrocarbons which yielded octane. The starting material butane is circulated through a reaction vessel exposed to the beam of an electron accelerator. A minimum of undesirable by-products are produced. Atlantic studies are continuing to determine the commercial feasibility of using atomic energy in manufacturing gasoline.

Dresser Net Earnings Up 72%

Earnings of Dresser Industries, Inc. showed an increase of 72% over the corresponding period a year ago, totaling $4,656,024, while sales for the same period were $62,688,896, an increase of 46% over the same quarter of 1955.

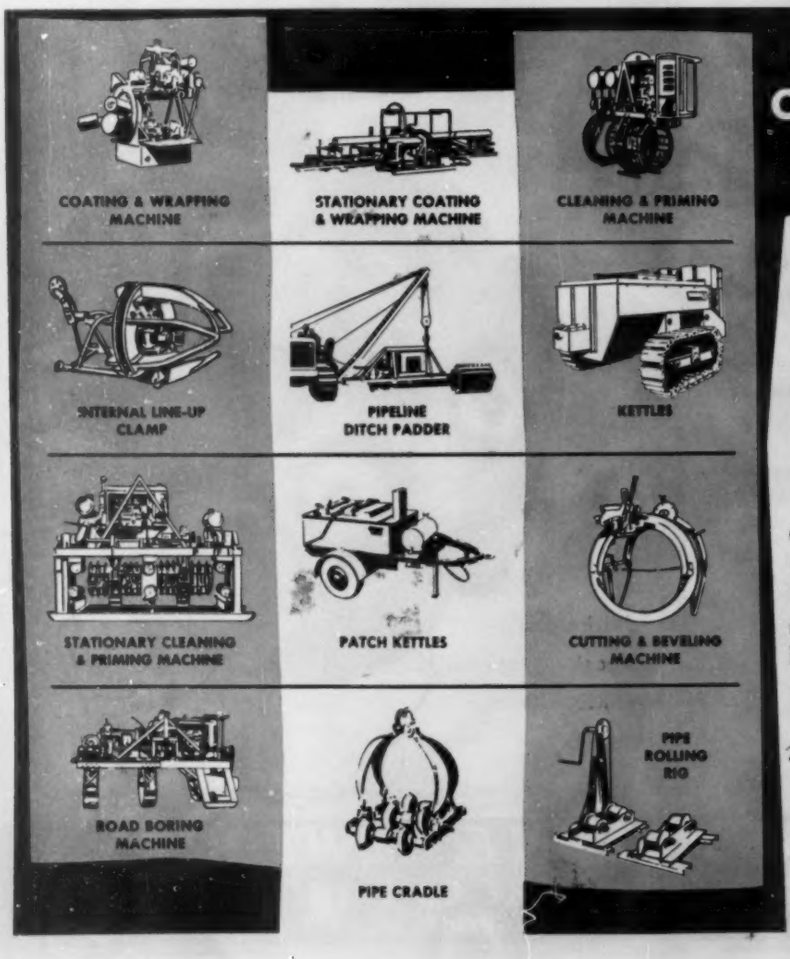
Earnings per share increased to $2.26 in the third quarter of the current year for a total of $5.68 as compared to $3.42 for the same period in 1955. Total net earnings for these three quarters amounted to $11,705,776, an increase of 67% over the same period in 1955.

Tidewater To Build Biggest Tanker Fleet

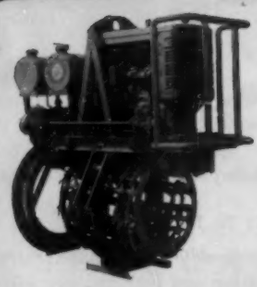
Tidewater Oil Co., one of the majors of the petroleum industry, is rapidly expanding its marine fleet to be the largest operated by any oil company. Two years ago Tidewater accepted delivery on four U. S.-built supertankers; the "S.S. Flying A Delaware" and the "S.S. Flying A New York," both in the 27,000-ton class, and the "S.S. Flying A California" and the "S.S. Flying A Washington," both 16,000-ton vessels.

Late last year and earlier this year Tidewater took delivery on two 45,000-ton vessels, the "S.S. Veedol" and "S.S. Wafra," both built in Japan, and last month launched the world's largest tanker, the "S.S. George F. Getty," weighing 52,000-tons, in France. Four more 45,000-tonners are under construction or on order in Japan and recent orders have been placed for the building of another two in the same class, from the Mitsubishi Shipbuilding Co.

The "S.S. George F. Getty" was the first of four identical ships ordered from Chantiers de l'Atlantique at Saint Nazaire and Ateliers et Chantiers de France at Dunkerque. In addition, Tidewater has ordered two 65,000-ton supertankers from the Dunkerque yard. When these ships have all been delivered, Tidewater will have the largest tanker fleet operated by an oil company.



CROSE LINE-TRAVELING CLEANING AND PRIMING MACHINE



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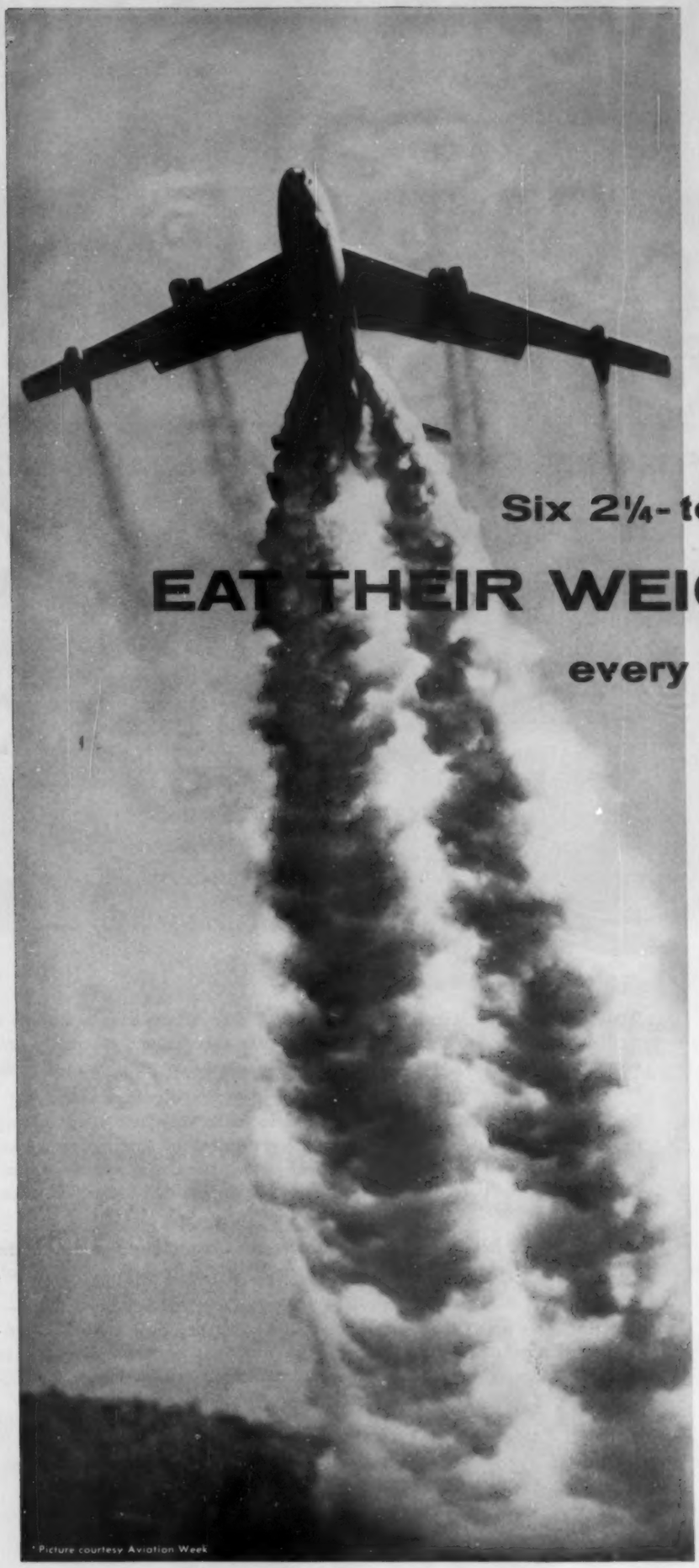

* Picture courtesy Aviation Week

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Conquest and challenge! One must follow the other, or progress ceases. Thus, every conquest of aviation unfolds a new challenge . . . and not always to those who make its giant birds.

The petroleum industry, for example, must feed thousands of hungry jet engines which gulp their weight in fuel every 40 minutes!

To Cities Service, a leader in aviation fuel, this staggering appetite means one thing: Find more oil! . . . a job which grows more difficult and more costly each year.

Nevertheless, by utilizing the finest men, machines, and methods, Cities Service is now accomplishing this job with an enviable record of efficiency.

Similarly, greater efficiency and expansion characterize other Cities Service operations. Manufacturing, marketing, research, sales—all reflect the rapidly growing demand for Cities Service products.

And more importantly, this growth is being used as a springboard into an even better future. For like the great aviation industry, Cities Service believes that when it comes to progress—the sky's the limit!

CITIES SERVICE

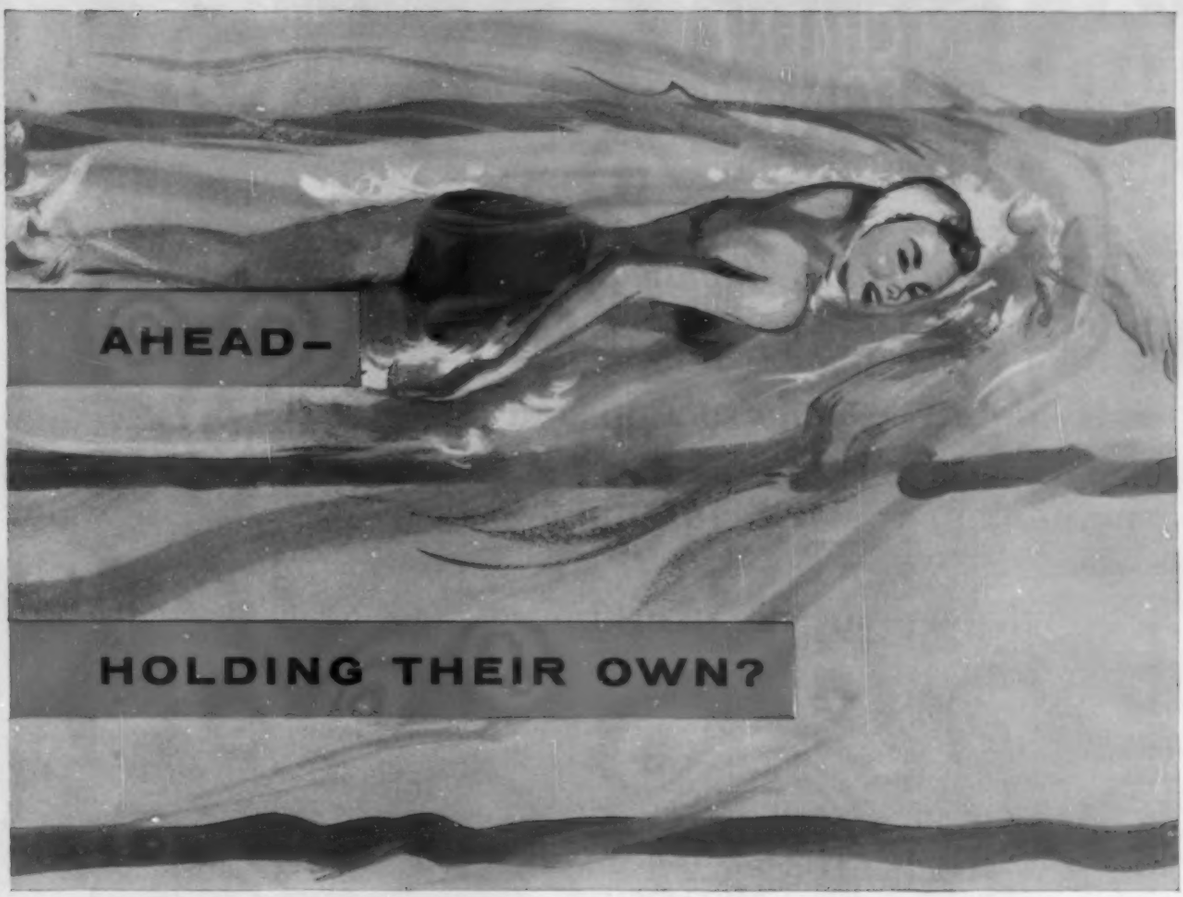
Progress through Service.

Today's constantly increasing demand for higher octane gasolines poses a challenge to every refiner. If you do not meet this demand efficiently and economically you may very well forfeit your competitive position in the race for the motorist's dollar.

So, look to your pool octanes. You need to make sure that your refining processes provide maximum quality to *every* gallon of gasoline produced. And this just can't be done with one high octane stream. It requires an improvement of the poorer quality blending components that lower pool gasoline octanes.

This is why UOP has devoted much of its research toward the up-grading of the poorest quality components that go to make up the finished gasoline pool.

An important result of this work is Universal's latest refining process—PENEX. This new process offers an efficient and practical method of upgrading pentane and hexane fractions, the previously neglected components that can so adversely affect the octane ratings of your pool gasoline.



In the race for higher octanes, you cannot afford to forget that the goal is to improve the general quality of your pool gasolines. PENEX offers a means of accomplishing this practically and economically. It should be given immediate consideration in your planning.

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ADVERTISERS' INDEX

(Advertising Agencies in Italics)

Air Pumps Ltd. 156
Goddard Watts Ltd.

John Allen & Sons (Oxford) Ltd. 129
Howard Bull Advertising

Ansul Chemical Company 3
Gotham-Vladimir Advertising, Inc.

Ashmore, Benson, Pease & Co. 21

The Atlantic Refining Company 30-31
N. W. Ayer & Son, Inc.

Avondale Marine Ways, Inc. 28
Whitlock-Swigart, Inc.

Baash-Ross Tool Company 11
Ruthrauff & Ryan, Inc.

E. B. Badger & Sons Limited 46
Thames Advertising Service Ltd.

A. Barton & Co. (Engineers) Ltd. 138

Bechtel Corporation 103
Ryder & Ohleyer, Inc.

Birkett, Billington & Newton Ltd. 163
S. C. Peacock Ltd.

Born Engineering Company 36
Watts, Payne Advertising, Inc.

British Petroleum Co. Ltd. 119
S. H. Benson Ltd.

British Thomson-Houston Co. Ltd. 171
Technical & General Adv. Agency

Peter Brotherhood Ltd. 162
J. Peers & Associates Ltd.

Burgess Products Co. Ltd. 147
Gee Advertising Ltd.

The Butterley Co. Ltd. 1
Rowlinson-Broughton

Cameo Products, Inc. 20
Vincent Pacelli Advertising

The Cape Asbestos Co. Ltd. 141
Taylor Advertising Ltd.

Cardwell Mfg. Co. 114-115
Lago and Whitehead, Inc.

Chicago Bridge & Iron Company 7
Russell T. Gray, Inc.

Cities Service Oil Co. 165
Ellington & Co., Inc.

Clark Brothers Company 130-131
The McCarty Company Adv. Inc.

Climax Rock Drilling & Engr. Co. Ltd. 5
The Technical Advertising Service

Cochran & Co. (Annan) Ltd. 147
The Technical Advertising Service

Crane Packing Ltd. 49
J. Ainsborough Everiss & Associates
Ruddock Advertising Agency

M. J. Crose-Mfg. Co., Inc. 164
Paul Locke Advertising, Inc.

Davison Chemical Corporation 25
St. Georges & Keyes, Inc.

Dawson & Downie Ltd. 116

Burton, Delingpole & Co. Ltd. 117
S. H. Wright & Co. Ltd.

Dikkers & Co. N. V. 19
"Advertentie" Reclame-advise en
Fotobureau "Advigrafs"

Dominion Engineering Co. Ltd. 24
Cockfield, Brown & Co. Ltd.

Dowell Incorporated 35
MacManus, John & Adams, Inc.

Dresser Industries, Inc. 122-123
Don L. Baxter, Inc.

E. I. du Pont de Nemours & Co., Inc. 17-18
Charles L. Rumrill & Co., Inc.

Esso Research & Engineering Company 133
McCann-Erickson, Inc.

Ethyl Corporation 13
Batten, Barton, Durstine & Osborn, Inc.

Foster Wheeler Corporation 32-33
Marsteller, Rickard, Gebhardt and Reed, Inc.

W. J. Fraser & Co. Ltd. 109
The Technical Advertising Service

General American Transportation Corp. 37
Weiss and Geller, Inc.

The General Electric Co. Ltd. of England 125
Kingscott Ltd.

Geolograph Company 162
Lowe Runkle Company

Geophysical Service, Inc. 145
Auld Advertising

Graver Tank & Manufacturing Co., Inc. 120
The Buchen Company

Matthew Hall & Co., Ltd. 150-151

Halliburton Oil Well Cementing Company 54
Hill & Christopher, Inc.

Heat & Power Company 132

Houdry Process Corporation 104
Arndt, Preston, Chapin, Lamb & Keen, Inc.

Hudson Engineering Company Cover III
Brennan Advertising Agency

F. A. Hughes & Co. Ltd. 127
Lashbrook Advertising

International Paints Ltd. 23
Mayfair Advertising Ltd.

Robert Jenkins & Co. Ltd. 169
Wm. Hopwood & Co. Ltd.

Kaiser Steel Corporation 39
Young & Rubicam, Inc.

Kali-Chemie AG 135

M. W. Kellogg Company 40
Fuller & Smith & Ross, Inc.

Ketjen 148
Raedt en Baet

Klemp Metal Grating Corporation 12
Elliot, Jaynes & Baruch

Richard Klinger Ltd. 139
R. F. White & Son Ltd.

Koenig Iron Works, Inc. 154
Bozell & Jacobs, Inc.

Lafarge Aluminous Cement Co. Ltd. 168
Allardyce Palmer Ltd.

Lake & Elliott Ltd. 144
Ripley Preston & Co. Ltd.

The London & Midland Steel Scaffolding Co. Ltd. 16
S. H. Wright & Co. Ltd.

The Lummus Company 52
G. M. Basford Company

Manning, Maxwell & Moore, Inc. 9
Fuller & Smith & Ross, Inc.

Mather & Platt Ltd. 48

McCullough Tool Company 2
Raymond O. Perry Advertising

Murray & Tregurtha, Inc. 160
Roy Elliott Company

National Radiac, Co. 132
Josephson, Gulick & Cuffari

Newalls Insulation Co. Ltd. 42
Doig Advertising Ltd.

Newman Hender & Co. Ltd. 152
Adams Bros. & Shardlow Ltd.

Nordstrom Valve Division 47
Rockwell Manufacturing Company
Marsteller, Rickard, Gebhardt & Reed, Inc.

Oil Center Tool Company Cover IV
Rives, Dyke & Company

Samuel Osborn & Co. Ltd. 44

The Ralph M. Parsons Company 143
Dozier Eastman and Company

Petroleum Information 142

Petro-Chem Development Co., Inc. 15
Sam J. Gallay Advertising

Petroleos Mexicanos 113

Petty Geophysical Engineering Company 153
Claude Aniol Associates

The Power-Gas Corporation Ltd. 21

D. & C. and Wm. Press Ltd. 45
Taylor Advertising Ltd.

Procon, Incorporated 51
Sam J. Gallay Advertising

Pye Telecommunications Ltd. 124
Arks Publicity Ltd.

Reed Roller Bit Company 158-159
Brennan Advertising Agency

Rubery, Owen & Co. Ltd. 169
Goddard Watts Ltd.

Ruston & Hornsby Ltd. 149
Industrial Publicity Services Ltd.

Scammell Lorries Ltd. 172
Wilcox Advertising Ltd.

Schlumberger Well Surveying Corporation 26-27
Rives, Dyke & Company

Sydney Smith & Sons Ltd. 107
S. H. Wright & Co. Ltd.

Socony Mobil Oil Co., Inc. 43
Compton Advertising, Inc.

Peter Spence & Sons Ltd. 111
Ripley Preston & Co. Ltd.

Standard Oil Company (New Jersey) 50
McCann-Erickson, Inc.

Standard Oil Company of California 10
Batten, Barton, Durstine & Osborn, Inc.

Standard-Vacuum Oil Company 161
Sam J. Gallay Advertising

J. Stone & Co. (Charlton) Ltd. 41
Stone & Webster Engineering Corporation,

Badger Process Division 46
Thames Advertising Service Ltd.

Sun Shipbuilding & Dry Dock Company 14
Doremus-Eshleman Company

The Texas Company 121
Cunningham & Walsh, Inc.

Timken Roller Bearing Company 22
Batten, Barton, Durstine & Osborn, Inc.

Union Carbide International Company 34
National Export Advertising Service, Inc.

Unit Crane & Shovel Corporation 4
Paulson-Gerlach & Associates, Inc.

Universal Oil Products Company 166-167
Sam J. Gallay Advertising

Universal Oil Products Company 157
Products Department
Sam J. Gallay Advertising

Vokes Ltd. 112
Crane Publicity Ltd.

Warren Petroleum Corporation Cover II
Chapman Company

Waukesha Motor Company 38
John G. Robel

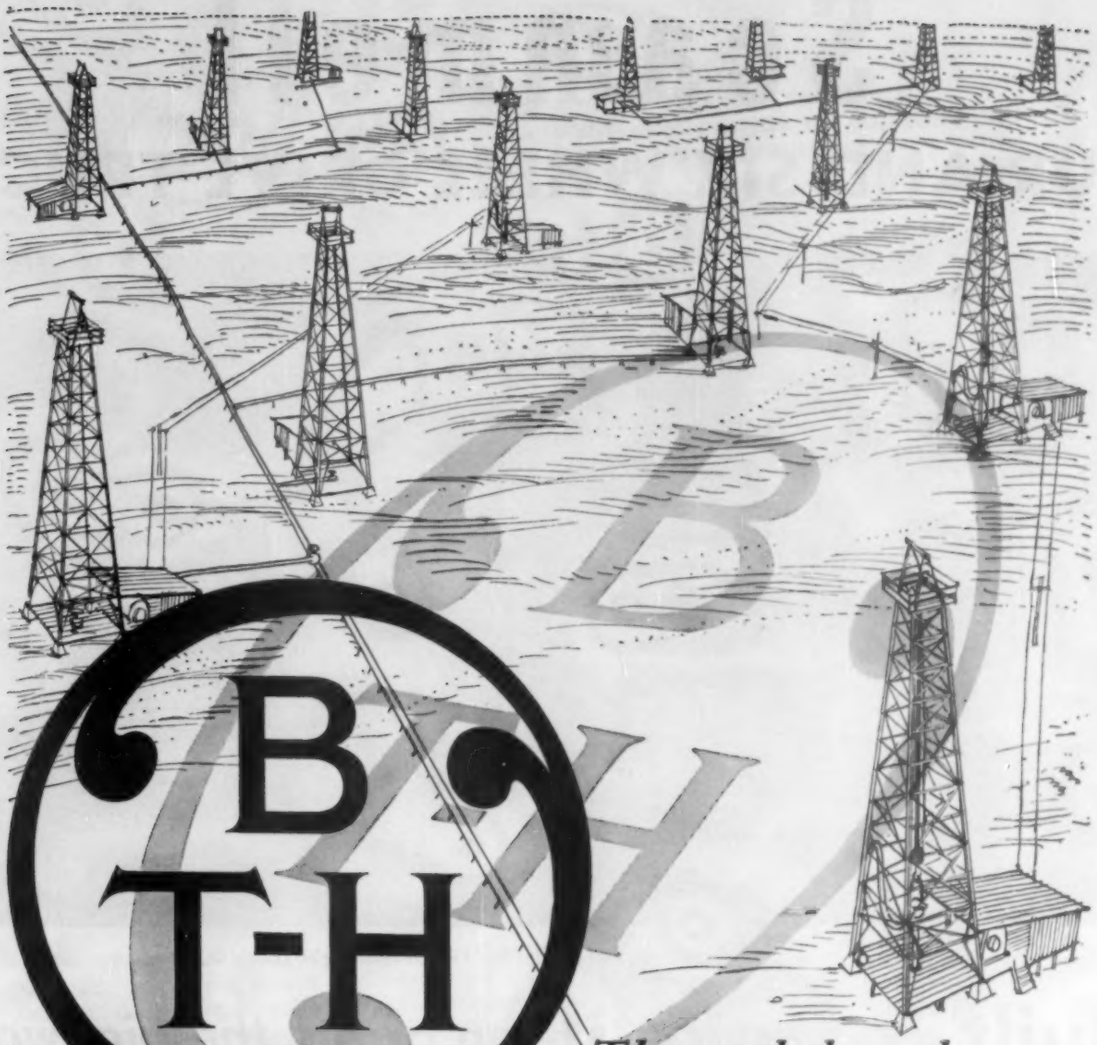
G. & J. Weir Ltd. 144
Scottish Industrial Advertising

Western Geophysical Company 155
L. J. Swain Advertising

Westinghouse Electric International Company 137
Ellington & Company, Inc.

Williams Brothers 146
Scot's Advertising

W-S Fittings Division, H. K. Porter Company, Inc. 29
W. L. Towne Advertising



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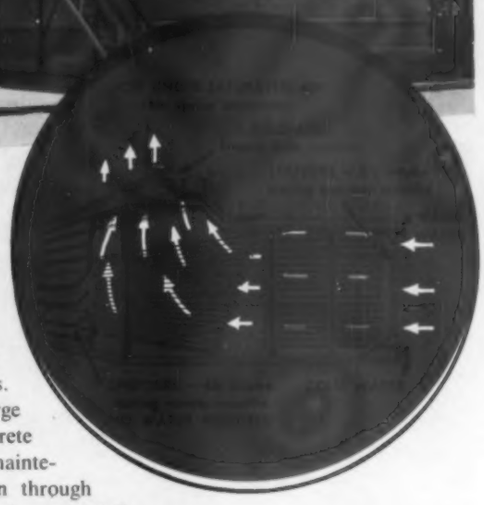

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The Combin-aire pictured above, installed in a large gas processing plant in northern Mexico, is of concrete construction, eliminating fire hazard and minimizing maintenance. As shown in the cut-away drawing, air is drawn through cooled water by fans located on top of the structure. The air, precooled and washed free of solids by the water, flows across the finned tube coolers, and leaves the top of the Combin-aire at elevated temperature under-saturated with water vapor. Mist carryover, condensation from effluent air, and air recirculation are thus eliminated. Combin-aires are installed adjacent to process equipment, minimizing piping and concentrating operating area.

In winter, air flows directly to the Solo-aire finned coolers, water circulation being unnecessary. Where water is required for shell and tube units or atmospheric sections, such water may also be cooled in the Combin-aire unit, eliminating the conventional cooling tower.

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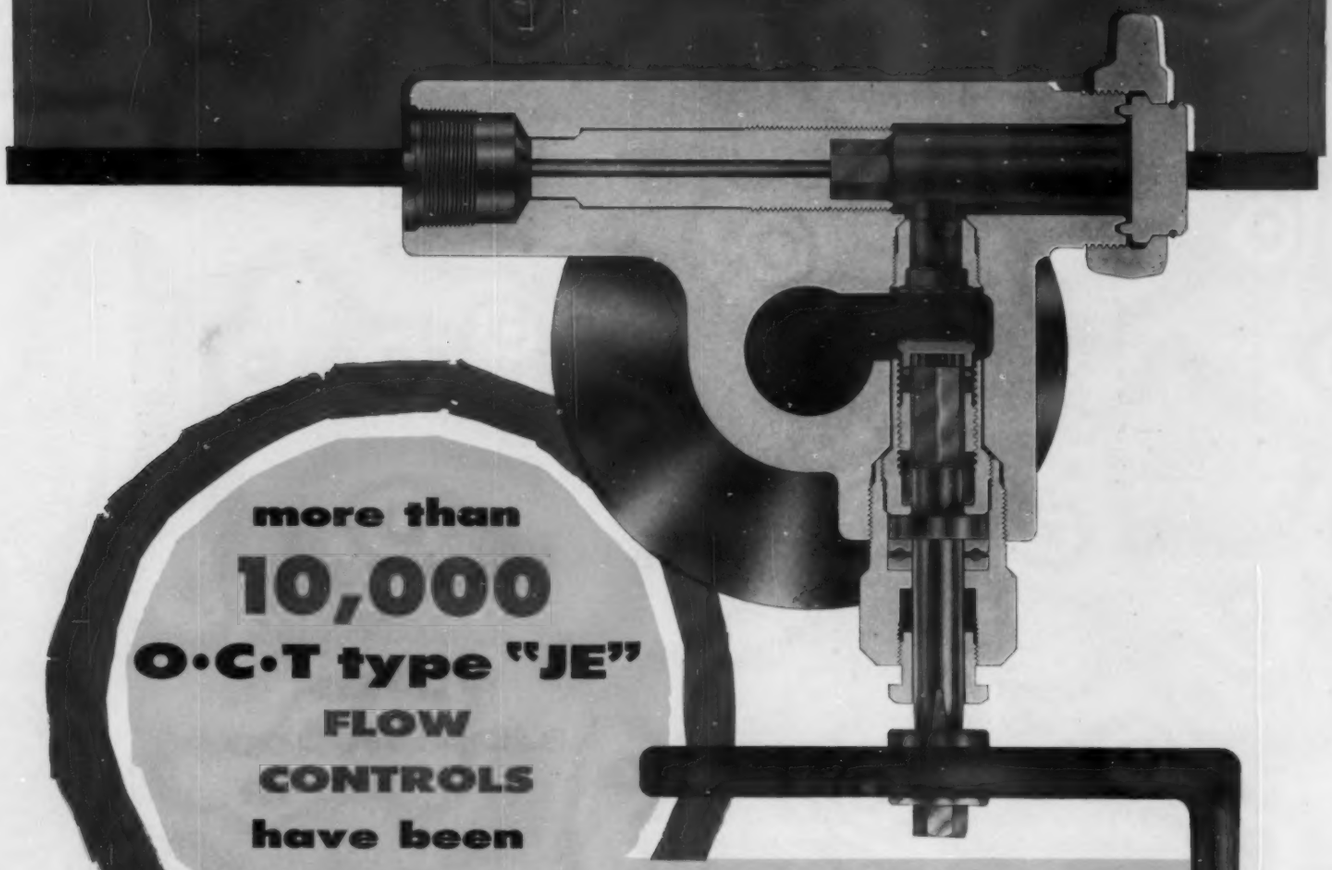

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